FOSSIL SPONGES

BRITISH MUSEUM.

CATALOGUE

OF THE

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OF THE

FOSSIL SPONGES

IN THE

GEOLOGICAL DEPARTMENT

OF THE

BRITISH MUSEUM

(NATURAL HISTORY).

WITH DESCRIPTIONS OF NEW AND LITTLE-KNOWN SPECIES.

(ILLUSTRATED BY 38 LITHOGRAPHIC PLATES.)

BY

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PREFACE.

In submitting the accompanying Monograph to the scientific public, I feel assured that the careful and conscientious manner in which Dr. Hinde has performed the very arduous task entrusted to him will meet with the well-earned recognition of all those who consult this work.

The earlier methods of classification of both the recent and fossil Spongidæ by their external form and habit of growth having been thoroughly tested and proved to be unreliable, the only sure method to be pursued—that of classifying them according to their intimate microscopic structure—has been adopted by Dr. Hinde, who, himself a pupil of the distinguished palæontologist Prof. Dr. Karl Zittel of Munich (one of our highest authorities in this class of organisms), has followed patiently the careful methods of research set forth in the 'Beiträge zur Systematik der fossilen Spongien' and other of Zittel's works.

It is no small gratification to know that the determination of this very difficult group of fossil organisms has now been so far completed, and that the types of those species not heretofore described are now all carefully figured in the Plates accompanying this Monograph, and the original specimens are preserved in the British Museum of Natural History.

HENRY WOODWARD,
Keeper of the Department of Geology.

British Museum (Natural History),
December 26th, 1883.

AUTHOR'S PREFACE.

AT the request of the Keeper of the Geological Department in the Natural-History Museum, I commenced, in the early part of 1881, the study of the collection of Fossil Sponges in the Museum with the view of arranging them systematically and preparing a simple Catalogue of their specific names and references. Hitherto no attempt had been made to place the Fossil Sponges in scientific order, and with the exception of the limited portion of the Collection formerly exhibited in the Museum at Bloomsbury, which had been mostly included in the comprehensive genera of *Spongia*, *Scyphia*, *Manon*, &c., the greater number of the specimens simply retained the labels of the localities and horizons from whence they had been derived. A preliminary examination made evident the fact that numerous specimens, more particularly those from British strata, were either quite new to science or had been described and figured in such an imperfect manner that their real characters were unknown. Under these circumstances a mere catalogue of names and references, such as had been at first proposed, would have been quite valueless; and, with the consent of the Trustees, it was decided to enlarge the plan and embrace in the Catalogue condensed descriptions of all the species from British strata and of the new species from foreign localities, with figures of all the new forms as well as of those which had been either inadequately figured previously, or of which it was desirable to illustrate the minute structure. To carry out this plan involved a far greater expenditure of time and work than was at first anticipated; but it is hoped that the results of nearly three years' study will be to place our knowledge of this group of fossils on a more satisfactory basis than hitherto.

The Museum collection includes examples of a very large majority of all the species of Fossil Sponges at present known, and, as may naturally be supposed, it is especially rich in those occurring in the rocks of this country. It contains amongst others the typical collections of William Smith, "The Father of English Geology," Toulmin Smith, Mantell, Bowerbank, and Cunnington. The fossil sponges from the Jurassic and Cretaceous strata of France, Switzerland, and Germany are also well represented. With a few unimportant exceptions, the Sponges from these countries have been clearly figured in the works of Goldfuss, Rœmer, Michelin, Quenstedt, Reuss, Geinitz, de Loriol, Fromentel, and others; and as their minute spicular structure has

been already described and illustrated in the works of Prof. Zittel, it has only been necessary for the purpose of the Catalogue to give references to the works in which the description of these forms will be found. The Sponges from British strata, on the other hand, have not received a similar amount of attention from the palæontologists of this country; and, with the exception of the forms treated of by Toulmin Smith and those lately described by Prof. Sollas, no systematic endeavour has hitherto been made to describe these organisms in detail; and therefore it has been necessary to supplement the meagre notices usually given, by such brief references to their minute structure as will enable them to be recognized.

I have followed in this Catalogue the classification of Prof. Zittel, the only one, in fact, which is at all applicable. Limitation of space has necessitated the omission of generic diagnoses, save in those cases in which new genera are introduced, or in which it has been needful to make emendations; and the student must therefore refer for these to Zittel's 'Handbuch der Palaeontologie' or to the "Studien über fossile Spongien" (Abh. bay. Akad. d. Wiss., Bd. 13, 1877–78). An English translation of the main portion of the generic descriptions, by W. S. Dallas, F.L.S., is contained in the 'Annals and Magazine of Natural History' for 1877, 1878, and 1879.

In a few instances I have described species of which the Museum does not at present possess any examples; but these forms will be found in the Museum of Practical Geology in Jermyn Street, and were kindly lent for examination by Prof. Archibald Geikie, LL.D., F.R.S.

The illustrations of the minute structure will, in some cases, appear defective—a result due, not to any lack of ability on the part of the artist, but to difficulties arising from the state of preservation of the fossils themselves. In all cases the endeavour has been to delineate the structure in its present condition.

I regret that it has not always been possible to give the exact localities of many of the Sponges from the Upper Chalk. This arises from the fact that the greater part of the collection made by Toulmin Smith is without any reference to the places from which the Sponges were obtained; but it is definitely known that they were procured from the counties of Kent, Surrey, and Sussex, and I have therefore catalogued such specimens as from the South of England.

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INTRODUCTION.

A SPONGE, in the ordinary acceptation of the word, is the internal framework or skeleton of an animal whose soft vital parts are composed of cellular protoplasm. This protoplasm in the living sponge is differentiated into two layers—an inner of ciliated cells, and an outer layer, named the syncytium, in which the cell-structure in the ordinary condition is not recognizable. It is in this syncytium or exoderm that the skeleton is secreted. In one small group of existing sponges the skeleton is wanting and the entire animal consists of fleshy sarcode; but the rest of the class secrete skeletons of very various composition and form. In the division to which the ordinary sponge of commerce belongs, the skeleton is composed of elastic fibres of a horny character, which anastomose together and build up those porous structures with which we are all so familiar. In another group the horny fibres have a central core composed of minute siliceous spicules usually secreted by the animal, though occasionally the central portion of the fibre is filled with grains of sand and other foreign particles which the sponge has selected from its surroundings. In yet other sponges the skeleton consists almost exclusively of minute siliceous or calcareous bodies, more or less intimately united together to form a resistant framework of a porous character, which is generally traversed by numerous canals. The minute mineral particles or spicules of the skeleton vary exceedingly in their form and arrangement in different groups; they possess an interior canal, and are built up of exceedingly thin concentric layers of silica or calcite mingled with organic material.

The classification of the Sponges, recent as well as fossil, rests upon the characters of their skeletal structures. The existing forms of the class have been divided into the following orders:—

1. MYXOSPONGIÆ, Haeckel.

Sponges destitute of a solid skeleton.

2. CERATOSPONGIÆ, Bronn.

Sponges with skeletons of horny fibres.

3. Monactinellidæ, Zittel.

Sponges with skeletons of horny fibres with cores of uniaxial siliceous spicules, or built up wholly of uniaxial siliceous spicules.

4. Tetractinellidæ, Marshall.

Sponges with skeletons of siliceous spicules, usually with four rays or arms, one generally elongated to form a shaft, the other three disposed in pyramidal form; uniaxial and star-shaped spicules are also present.

5. Lithistidæ, O. Schmidt.

Sponges with skeletons of siliceous spicules, either four-rayed or irregular in form, which are intimately interwoven together into a continuous mesh.

6. Hexactinellidæ, O. Schmidt.

Sponges with skeletons of six-rayed siliceous spicules, either loosely interwoven together, or organically united to form a continuous mesh.

7. Calcispongiæ, Blainville.

Sponges with skeletons of calcareous spicules.

The first of these existing orders, the Myxospongiæ, is, of course, quite unknown in the fossil state, and it is also very doubtful whether any remains of the next order, the Ceratospongiæ, have been preserved. Certain casts of cylindrical bodies from the Cretaceous system have been regarded as belonging to horny sponges; but in the absence of all other characters but that of outward form these bodies cannot be definitely placed in this group.

The Monactinellidæ have comparatively few representatives in the fossil state, and they present a striking contrast to the abundance of this order in the present seas. Their rarity as fossils, however, is not to be accepted as an indication of their scanty existence in the past, but is more probably owing to the fact that the spicular structure of these sponges is unsuitable to their preservation as fossils.

The structure of the Tetractinellidæ, like that of the order just mentioned, is also but little adapted to the retention of the form of these sponges in the fossil state; but the constituent spicules of many of these sponges are relatively large and robust, so that they are capable of preservation, and they are frequently met with detached and scattered through the rocks. In some instances they are sufficiently numerous to form thin beds, almost exclusively composed of spicules. It is therefore probable that this order of sponges flourished as abundantly in the seas of the Neocomian period as at the present day.

Lithistid and Hexactinellid sponges, unlike those of the previous groups, are more numerous and varied in the fossil than the recent state. The spicular components of the skeleton in these sponges are firmly attached together, consequently the form of the sponge is frequently preserved intact, even in cases where the spicules themselves have subsequently been destroyed. The occurrence of detached spicules and fragments of the skeleton scattered through the rocks plainly shows, however, that only under favourable conditions of fossilization has the form of the sponges been retained, and those now remaining probably comprise but a small proportion of the number which previously existed.

Fossil Calcareous sponges are abundant in certain strata, but they belong to a family which differs to such an extent from existing Calcispongiæ that the relationship has been greatly doubted. Recent discoveries, however, prove that the component spicules in the fossil Calcispongiæ possess the closest resemblance to those of the living examples of the order.

In respect to their form and dimensions, fossil sponges present as great diversity as living ones. The most prevalent form is like a cup, funnel, or vase; but cylindrical, club-shaped, fan-shaped; and branching examples are also very abundant. The smallest complete fossil specimen which has come under my notice is a Calcisponge, belonging to the genus *Peronella*, which measures 5·5 millim. in length by 4 millim. in width; whilst the largest is a Lithistid, belonging to the genus *Doryderma*, which reaches a length of 390 millim. by 135 millim. in diameter.

Fossil sponges are of most common occurrence in calcareous and arenaceous rocks, whilst they are rarely met with in shales and deposits formed from muddy sediments. Strata containing masses and nodules of flint and chert frequently abound in fossil sponges; indeed there is every reason to suppose that the flint and chert itself is derived from the dissolved skeletons of siliceous sponges. Both arenaceous and calcareous deposits seem to have been favourable to the existence of Tetractinellid and Lithistid sponges, for they occur alike in the Lower and Upper Green Sands as well as in the Chalk. The Hexactinellid sponges, on the other hand, favour more particularly the deeper-formed deposits of limestone and chalk, though rarely forms of this order are present in the Upper Green Sand; and, according to Manzoni*, they are comparatively numerous in Miocene strata in Italy, associated with shallow-water organisms. The Calcispongiæ, on the other hand, are most abundant in arenaceous or shallow-water deposits, and thus in their habitats resemble the existing members of the order. Exceptions, however, occur in this group, for several Calcisponges are found in Jurassic limestones associated with Hexactinellids, and in one example in the Museum a species of *Peronella* is growing attached to the surface of a Hexactinellid sponge.

At the present day, with the exception of the genus *Spongilla*, which inhabits fresh

* Spugne silicee del Miocene medio.

water, all the members of the class live in the sea. It is interesting to note that the spicules of a fossil species of *Spongilla* have been discovered in chert, of freshwater origin, in beds of Purbeck age.

The Alterations produced by Fossilization in the Structure of Sponges.—The changes to which fossil sponges have been subjected in the process of fossilization have oftentimes resulted in the partial or complete destruction of their original spicular structure and the replacement of the mineral composition of the skeleton to such an extent that great controversy has arisen respecting its original nature. In recent sponges the skeleton is composed either of amorphous silica or carbonate of lime with a small quantity of organic material. In fossil sponges the organic material would of course disappear, and only the mineral constituents of the spicules remain. But even the mineral portion is seldom, if ever, in the same condition as in recent spicules; the amorphous silica and calcite have been replaced by crystalline silica and crystalline calcite, as well as by peroxide of iron and iron pyrites; whilst not infrequently the entire mineral structure has been dissolved and removed, leaving the empty moulds of the spicular skeleton in the matrix. As a result of these changes, siliceous sponges now occur with skeletons of calcite, and calcareous sponges with fibres composed of silica. These changes are intimately connected with the character of the strata in which the sponges are imbedded, but the causes producing them have not up to the present been satisfactorily determined. In general the sponges in calcareous strata have undergone the greatest alteration, the siliceous structures being replaced either by calcite or iron peroxide, or dissolved away altogether, whilst the structures of calcareous sponges, in common with the shells of mollusks in the same strata, are oftentimes replaced by silica. In arenaceous or glauconitic strata, on the other hand, the changes, whether of siliceous or calcareous sponges, have been much less extensive than in strata of a calcareous character.

Changes produced in the Structure of Siliceous Sponges.—It may be affirmed that no examples are known in which the siliceous spicules or fibres of fossil sponges retain the perfect amorphous condition of the silica as in existing sponges. The nearest approach to this original amorphous condition is shown in sponges preserved in the glauconitic marls of Westphalia of the age of the Upper Chalk. The spicules of these sponges have a smooth milky white aspect, and, when examined under the microscope mounted in Canada balsam, exhibit the details of the interior canals and the spinous adornment of their surfaces in beautiful preservation. When viewed by polarized light they are either neutral or occasionally present faint prismatic tints. The main feature which distinguishes these from recent spicules is their white porcellanic aspect, which contrasts greatly with the glassy appearance of recent spicules.

The mineral condition of some of the siliceous sponges from the Upper Green Sand of Warminster also resembles that of the examples from Westphalia mentioned above; but they present the interesting peculiarity of being inclosed in a matrix of translu-

cent glassy silica, which is shown to be crystalline by giving brilliant prismatic tints under the polariscope; whilst the spicules, on the other hand, are either neutral or only give faint prismatic tints, thus indicating that the silica of which they are composed is in a crypto-crystalline condition.

In the siliceous sponges from the Jurassic limestones of Franconia, which yet retain a siliceous structure, the silica, seen by reflected light, has a white snowy aspect, and is distinctly crystalline in character. In this condition the spicular elements are nearly invisible when mounted in Canada balsam, but in glycerine or water show perfect definition. The mineral change in these sponges, however, does not appear to have affected the finer structural details of the skeleton, which are usually well preserved.

Most of the siliceous spicules from the Lower and Upper Green Sand and from the interior of chalk flints exhibit an exterior surface-aspect like that of ground-glass, which is seen under the microscope to be owing to the minutely eroded condition of their surfaces. The silica composing them is now crystalline, and frequently appears like delicate fibres radiating from different centres. In these spicules the canals are usually infiltrated with silica; in a few instances, however, they are filled with iron peroxide.

Another modification of the silica is presented by sponges from the Upper Chalk of Flamborough, in Yorkshire, which are so distinct in their mineral characters that they can be at once recognized by this feature alone. On removing the chalky matrix by acid the sponge itself is usually perfect in outer form, and the fibrous mesh has a rough surface-aspect, as if composed of minute granular particles of a dull earthy greyish aspect. Thin sections of the fibre show that the silica is distinctly crystalline. In these sponges the spicular components of the skeleton, save in a few examples where they possess relatively large dimensions, are not distinguishable; they appear to have been, as it were, fused together, so that the individual forms are entirely obliterated.

Siliceous Sponges inclosed in Chalk Flints.—The sponges met with in the interior of chalk flints present very various conditions of preservation. In some examples the flint is hollow and the interior cavity is partially or wholly filled with a fine powdery material, largely made up of detached Tetractinellid sponge-spicules, which are now composed of crystalline silica. In other cases the hollow flint incloses the perfect form of a sponge, whose walls are either in immediate contact with the interior surface of the flint, or separated therefrom by a small space usually filled with a white siliceous powder. The sponges thus inclosed frequently retain the spicular structure of the outer surface in perfect preservation, particularly those species with relatively large spicules; and even in some instances the minute spicules of the dermal layer of the sponge yet remain intact and in their relative positions. This favourable state of preservation, however, is limited to the outer surface of the sponge, for the spicular

structure of the interior is completely obliterated, and is now a mass of botryoidal or porous crypto-crystalline silica, in which even the course of the canals has disappeared. The surface spicular structure is usually of a snowy white aspect, and the silica is crystalline.

In other examples, of somewhat rare occurrence, the hollow flint contains merely the solid casts, in silica, of the central cloaca and canals of the sponge, whilst the spicular skeleton itself has entirely disappeared.

In all the instances above quoted the sponges are contained in *hollow* flints; but numerous examples occur in which the inclosing flint is quite solid. In some cases the flint nodule has a rough conformity to the form of the sponge, in others no relation is apparent. As a general rule the spicular structure in these solid flints is completely obliterated, and the interior of the flint merely exhibits the cloacal cavity and canals, which are distinguishable from the circumstance that the silica which has infilled them is of a different tint from that of the rest of the nodule.

Spicules of Tetractinellid and other sponges also occur scattered loosely in strata of glauconitic sand and in places aggregated together into distinct beds. Sometimes the individual spicules can be distinguished on the weathered surface of these sponge-beds; but in the interior of the beds the spicular forms are merged into glassy chert. The silica of these spicules is usually crystalline. These spicules and spicular masses occur in the Hils formation of Germany, in Neocomian sandstone at Haslemere in Surrey, in the Kentish Rag quarries near Maidstone in Kent, at Folkestone, and in the Upper Green Sand of Blackdown and the Haldon Hills in Devonshire. Spicules of siliceous sponges in connexion with beds or nodules of chert have been met with in Carboniferous strata in Ireland, in Lias strata from the Austrian Tyrol and Glamorganshire, and in the Portland limestones of Upway in Dorsetshire.

Siliceous Spicules replaced by Peroxide of Iron and Iron Pyrites.—Examples where the original silica has been replaced by pyrites are not of very common occurrence. A well-known instance is that of the earliest known sponge, *Protospongia fenestrata*, Salter, from the Menevian of Wales, where the sponge is imbedded in black shale. In a few sponges from the Jurassic limestones, the Grey Chalk, and the Upper Chalk the same replacement occurs.

The replacement of silica by peroxide of iron is of extremely frequent occurrence, particularly in the sponges from the Upper Chalk of this country. The peroxide is present as a light reddish-brown powdery material, usually incoherent, though in a few instances sufficiently firm to retain the spicular mesh intact after the removal of the chalky matrix. As a general rule, however, the sponge-structure when replaced by peroxide is extremely indistinct and merely represented by a thin rusty film, in which the character of the spicules is generally obliterated. Unfortunately most of the siliceous sponges from the Upper Chalk of the south of England, which have not been inclosed in flints, are in this very unsatisfactory condition; and the task of

discovering their true characters is rendered very difficult. But even in many of the sponges inclosed in solid flints the silica has been replaced by peroxide of iron; and the former presence of the sponge is indicated by reddish markings in the flint. These are particularly noticeable in the case of sponges belonging to the genus *Plocoscyphia*, which are characterized by thin anastomosing walls. These walls appear in section on the surface of broken flints as delicate labyrinthine lines of a reddish tint. In a few cases where the spicular structure is of an open character it has been replaced by peroxide of iron in such a manner that the form of the spicules is perfectly preserved.

Siliceous Spicular Structure replaced by Calcite.—The fact of calcite taking the place of silica in fossil sponges has been greatly contested on account of the supposed more stable character of silica in comparison with calcite. But the frequency of the occurrence of undoubted siliceous sponges with skeletons in the condition of calcite is a convincing proof of the instability of the colloid silica of sponge-skeletons. The calcite which has replaced the silica is in a crystalline condition, and it appears to have infiltrated the moulds after the siliceous skeleton has been dissolved and removed. In the case of relatively large spicules, and where the skeletal mesh is of an open character, the replacement has been effected without obliterating the character of the structure; but in those instances where the spicules are minute and they are united closely together, the finer details have disappeared, and only general, ill-defined outlines of the original spicules and skeleton remain. As a rule the spicular canals are obliterated where calcitic replacement has taken place; but occasionally some other material has filled in the canals previous to the deposition of the calcite, and in that case they can be distinguished.

Instances of the replacement of siliceous sponges by calcite occur in Silurian, Devonian, Jurassic, and Cretaceous strata. The replacement appears to be confined to sponges imbedded in calcareous or marly deposits. I am not aware of a single instance occurring in arenaceous beds. The majority of the siliceous sponges from the Jurassic limestone in certain localities are now calcareous, whilst in the same strata elsewhere the same species of sponge remains siliceous. Not unfrequently too the same individual specimen will be partly siliceous and partly calcareous; in the siliceous portion the spicules will retain their canals and other finer details, whilst in the calcareous portion the spicules will be solid and the outlines of the skeletal mesh confused and indefinite. In the sponges from the Upper Green Sand (so-called) of Cambridge and the Grey Chalk strata of Dover and Folkestone the silica has been almost entirely replaced by calcite. In some of the Upper Chalk sponges from Flamborough, calcite has partially replaced the silica; but, as a rule, the skeletons of the sponges from this locality remain siliceous. In only one instance have I found *detached* spicules of siliceous sponges changed to calcite, and this occurs in the spicules of *Astræospongia* from the Silurian strata of Gotland.

Siliceous Spicular Structure dissolved, leaving empty Moulds.—This condition is of frequent occurrence in beds where the matrix is suitable for retaining the form of the spicular mesh, and it furnishes a clear proof of the ready solubility of siliceous sponge-structure. The siliceous skeleton of these sponges has been entirely removed, so that there are only empty cavities in the place of the solid spicular arms and nodes. These moulds are sometimes present in a matrix of chert or flint, of which there are examples in the Silurian strata of North America and in the Upper Green Sands of Wiltshire; they also occur in compact Jurassic limestones, in the Cambridge Green Sand, and even in the Upper Chalk of the south of England. It is somewhat surprising that the empty moulds of the delicate sponge-skeleton should have been retained in the soft Chalk of the south of England; but they have been so perfectly preserved that in many instances the moulds of the delicate balks or rods which form the lantern-like nodes of Hexactinellid sponges remain intact. Not only are the connected skeletons of Hexactinellid sponges thus dissolved, but the detached spicules of Tetractinellid sponges, though relatively much larger and more robust, have also, in many instances, suffered a similar fate. A noted example occurs in beds of the Hils sandstone in the north-west of Germany, where the moulds of the spicules remain in a matrix of semi-translucent chert, giving to it a porous aspect. Other instances are present in Lower Green Sand chert from near Haslemere in Surrey. In some of the specimens from this latter locality the spicular canal had become infilled with silica before the solution of the spicule itself, and this solidified canal now remains as a delicate rod in the central axis of the hollow mould. In some sponges from the Upper Green Sand the spicular skeleton seems to have been incrusted with a thin delicate film of silica, which now remains after the solution and removal of the skeleton. In some examples of Miocene Hexactinellid sponges described and figured by Manzoni * the skeleton is similarly incrusted with a siliceous pellicle, but it has not been subsequently dissolved.

Changes produced in Calcareous Sponges by Fossilization.—As a rule the mineral structure of fossil calcareous sponges has undergone fewer changes than the structure of siliceous sponges, though, as a result of the small dimensions of the calcareous spicules and their very intimate disposition in the fibre, a very slight amount of alteration has been sufficient to obliterate the form of the individual spicules, and to merge them into a common fibrous mass of amorphous or crystalline calcite. In general the calcareous sponges imbedded in arenaceous strata are better preserved than those from calcareous beds. In the numerous calcareous sponges from the Neocomian gravels of Farringdon, in Berkshire, the sponge-fibre is enveloped in a coating of dog-tooth crystals of calcspar. The microscopic structure of these sponges is very imperfectly preserved. The fibre of the calcareous sponges from the Upper Green Sand of Warminster is of a soft earthy character with a greyish-white tint, and

* Spugne silicee del Miocene medio, t. 5. f. 15.

in some cases so slightly altered that the minute component spicules can be detached. The fibre of the calcareous sponges from Essen resembles in appearance that of the Warminster sponges; but the individual spicules are, as a rule, not recognizable. The fibre of the calcareous sponges from the Upper Chalk of the south of England is in appearance smooth, white, and unaltered; but in thin sections the component spicules are rarely visible, and the fibre presents either a homogeneous mass of amorphous calcite or a very fine radiate crystalline structure.

Calcareous Sponges replaced by Silica.—The instances in which this change has been effected are comparatively rare, and limited, with few exceptions, to sponges imbedded in strata in which the remains of other calcareous organisms have likewise been replaced by silica. I have not met with a single example of this change in any of the numerous calcareous sponges from the Lower and Upper Green Sands of this country; but in the Jurassic strata of certain localities in Germany many of these sponges have become silicified, and can be perfectly freed from the calcitic matrix by acid. The fibre of such sponges after treatment with acid has a rough appearance, and is of a snowy white tint; and, as may be expected, all traces of spicular structure have disappeared. A partial replacement by silica is sometimes present in examples of the well-known *Pharetrospongia Strahani*, Sollas, from the Upper Green Sand of Cambridge. The fibre of these sponges is calcareous in the central portion, whilst the exterior has been replaced by silica. This change is more remarkable from the fact that the form of the individual spicules has not been destroyed, but they can be distinguished in a siliceous condition. This same species of sponge remains completely calcareous when imbedded in the Upper Chalk; but when inclosed in solid flints the outer surface of the fibre has become silicified, whilst the interior remains calcareous, in the same manner as in the Green-Sand specimens.

Geological Distribution.

Fossil sponges make their appearance in some of the earliest fossiliferous rocks, and they are present, though by no means in continuous sequence, in all the great divisions of the geological scale to the Tertiary era. They form, however, but a very subordinate part of the fossil fauna of the Palæozoic and early Mesozoic groups, and it is not until towards the close of the Jurassic and during the Cretaceous periods that they occur in sufficient numbers to constitute a relatively important feature of the fauna of these rocks. Judging by the constant association of sponges with beds of flint and chert in the Mesozoic rocks, there is great reason to suppose that they may have existed in strata of Palæozoic age where beds of these materials are present, though up to the present they have not been recognized in them.

Cambrian System.—The earliest known sponge is the *Protospongia fenestralis*, Salter, belonging to the Hexactinellidæ. It is only known from fragments and detached spicules, preserved in black shales in strata of Menevian age in Wales and in Sweden.

In the Quebec series of Canada there are numerous fossils which have been referred to sponges by the late Mr. Billings; but as nothing definite is yet known of their minute structure, the true character of these fossils remains doubtful. They have been placed in the genera *Archæocyathas*, *Calathium*, *Eospongia*, *Rhabdaria*, and *Trachyum*.

Silurian System.—Sponges are by no means generally distributed in Silurian strata, though they are not uncommon in beds of the Niagara series in North America and in strata of corresponding age in the Silurian basin of the Baltic. They are also present in the Boulder drift beds of North Germany. The order Monactinellidæ is here represented for the first time by the genus *Climacospongia*, the Lithistidæ by *Aulocopium*, *Hindia*, and the somewhat doubtful *Aulocopina*. Belonging to the Hexactinellidæ are the genera *Protachilleum*, *Astylospongia*, *Palæomanon*, and the remarkable genus *Astræospongia*. The genus *Amphispongia* from the Upper Silurian of the Pentlands is a dubious form, and also the genus *Brachiospongia* from the Niagara group of North America.

Devonian System.—Very few sponges have as yet been discovered in rocks of this age. To the Monactinellidæ belongs the genus *Lasiocladia* from Belgium. No member of the Lithistidæ has yet been discovered in this division. The Hexactinellidæ are represented by *Astræospongia* from Belgium and Illinois, and by the peculiar genus *Dictyophyton* from the Upper Devonian strata of New York. Calcareous sponges belonging to the genus *Peronella* also appear here for the first time.

Carboniferous System.—From the Carboniferous Limestone of Scotland the Monactinellid genera *Pulvillus*, *Raphidistia*, and *Reniera* have been described by Mr. Carter, as well as the Hexactinellid *Hyalostelia* and *Holasterella*. Detached spicules of Lithistid and Tetractinellid sponges also occur. Lately Steinmann has described three genera, *Sollasia*, *Amblysiphonella*, and *Sebargasia*, of the family of the Pharetrones, from the Carboniferous of Spain; but as no spicular structure has been preserved, the character of these forms is at present uncertain.

Permian System.—No well-ascertained sponges have been met with in this division. According to Prof. Zittel, the genus *Bothroconis*, King, might prove to be a Hexactinellid, and *Eudea tuberculata*, King, a calcareous sponge; but these forms have not come under my notice, and, judging from the figures given of them, their true characters appear to be very uncertain.

Triassic System.—No siliceous sponges have been recorded from this division, but in the St.-Cassian beds in the Tyrol numerous calcareous sponges are present. As a rule, the fibre of these forms does not show any minute structure, and the sponge-character of some of them is very problematic. These St.-Cassian forms have been included in the following genera—*Eudea*, *Colospongia*, *Verticillites*, *Celyphia*, *Himatella*, *Peronella*, *Corynella*, *Myrmecium*, and *Stellispongia*.

Liassic System.—It is only within the present year that fossil sponges of this

period have been discovered. In strata of this age at Schafberg, Austria, Prof. Zittel discovered beds of agglomerated spicules of Monactinellid, Tetractinellid, and Hexactinellid sponges, which have been described and figured by Dunikowski *. In cherty strata in Glamorganshire there are also numerous spicules.

Jurassic System.—The sponges of this division are very numerous. The Monactinellidæ are represented by the single freshwater genus *Spongilla*, from Purbeck strata in the south of England. The Lithistidæ and Hexactinellidæ are met with in great numbers in different zones of the Upper Jurassic, in South Germany, Switzerland, Eastern France, and in the vicinity of Cracow; but they are entirely absent in the strata of corresponding age in England. In some of the Portland beds, however, there are large masses and nodules of flint, which probably indicate the former existence of sponges in these strata; and in some of these flints detached spicules of Tetractinellid sponges are still preserved. The Lithistids of the Upper or White Jura of Germany belong to the following genera—*Cnemidiastrum*, *Corallidium*, *Hyalotragos*, *Pyrgochonia*, *Leiodorella*, *Platychonia*, *Placonella*, *Megalithista*, *Cylindrophyma*, *Melonella*, and *Lecanella*. The Hexactinellids are included in the genera *Tremadictyon*, *Craticularia*, *Sphenaulax*, *Sporadopyle*, *Verrucocœlia*, *Pachyteichisma*, *Trochobolus*, *Phlyctænium*, *Cypellia*, *Stauroderma*, *Porocypellia*, *Casearia*, *Porospongia*, and *Toulminia*. In most of these siliceous sponges the original skeleton has been replaced by calcite; but in the strata of some localities the sponges yet retain their siliceous structure in very perfect preservation. There are but few calcareous sponges in the English Jura; but they abound in the Jurassic strata of France and Germany, and have been referred to the genera *Eudea*, *Peronella*, *Eusiphonella*, *Corynella*, *Myrmecium*, *Lymnorea*, *Stellispongia*, *Sestrostomella*, *Blastinia*, *Oculospongia*, *Crispispongia*, *Pharetrospongia*, and *Protosycon*.

Cretaceous System.—Both the Siliceous and Calcareous sponges may be said to attain their maximum development in this period. In this country there are four well marked zones in the Cretaceous rocks, each characterized by distinctive groups of sponges. They are (I.) the Lower Green Sand, (II.) the Upper Green Sand and Chloritic Marl, (III.) the Chalk Marl, Gray Chalk, and Lower Chalk, and (IV.) the Upper Chalk, including the Maestricht Chalk.

(I.) *Lower Green Sand.*—Very few recognizable siliceous sponges occur in this division; but in sandstone strata at Haslemere, in Surrey, there are thin beds nearly entirely composed of the spicules of Tetractinellid sponges, with an admixture of a few Hexactinellid and Lithistid forms; some of these latter are sufficiently characteristic to be referred to the genus *Mastosia*. Similar beds of sponge-spicules also occur in the Hils sandstone in Westphalia. On the other hand, the calcareous sponges are very numerously represented in this series, not only in this country, but in France, Germany, and Switzerland. The gravels of Farringdon in Berkshire, and

* Spongien, Radiolarien und Foraminiferen der unterliassischen Schichten vom Schafberg. Wien, 1882.

at Upware in Cambridgeshire, are filled with these sponges. The minute structural characters of the sponges from these beds has only been partially preserved; but traces of the spicules can usually be distinguished in thin microscopic sections. The following genera are represented—*Verticillites*, *Peronella*, *Elasmocœlia*, *Conocœlia*, *Corynella*, *Synopella*, *Oculospongia*, *Elasmostoma*, and *Pharetrospongia*.

(II.) *Upper Green Sand and Chloritic Marl.*—In beds of this series at Warminster in Wiltshire, Blackdown and Haldon in Devonshire, the Isle of Wight, near Folkestone, and near Havre in France, sponges are very numerous. In some localities the beds are largely made up of spicules of Monactinellid and Tetractinellid sponges with an admixture of Lithistid and Hexactinellid spicules, and resemble those already mentioned from the Lower Green Sand. These detached spicules have been described and figured by Mr. Carter * and Mr. Parfitt †. The Lithistid sponges of this series are particularly abundant, and, as a rule, retain their siliceous composition; but as they are usually preserved in a very hard siliceous matrix, it is only by preparing sections that the structure can be distinguished. The genera of Lithistids comprise *Chenendopora*, *Jereica*, *Doryderma*, *Holodictyon*, *Pachypoterion*, *Nematinion*, *Carterella*, *Phymatella*, *Trachysycon*, *Siphonia*, *Hallirhoa*, *Jerea*, *Polyjerea*, *Kalpinella*, and *Rhopalospongia*. The Hexactinellids are less numerous in proportion to the Lithistids, and belong to the genera *Craticularia*, *Stauronema*, *Sestrodictyon*, *Guettardia*, *Eubrochus*, *Plocoscyphia*, and *Sclerokalia*. Calcisponges are numerous in some localities: the most important place for them is Essen, in Prussia; they are also present at Warminster and near Havre. They mostly belong to the same genera as those in the Lower Green Sand; but the majority of the species are different.

(III.) *Chalk Marl, Gray Chalk, and Lower Chalk.*—Beds of this series near Dover, Folkestone, and in the Isle of Wight contain a well-marked group of sponges, for the most part of the same genera as those in the underlying Upper Green Sand and Chloritic Marl, but of different species. The siliceous skeleton of these sponges has been replaced by calcite, and their present condition is very unfavourable for determination. The sponges from the Chalk Marl of the Isle of Wight, however, remain siliceous, and can be partially cleaned from the matrix by acid. The Lithistids of this series of beds are included in the genera *Stachyspongia*, *Phymatella*, *Siphonia*, *Jerea*, *Nelumbia*, *Polyjerea*, and *Thamnospongia*. The Hexactinellids associated in the same beds with the Lithistids belong to the genera *Craticularia*, *Strephinia*, *Verrucocœlia*, *Stauronema*, *Leptophragma*, *Guettardia*, *Sestrocladia*, *Ophrystoma*, and *Plocoscyphia*. I do not know of any Calcisponges from this division.

(IV.) *Upper Chalk, including Maestricht Chalk.*—Siliceous sponges abound in this division of the Cretaceous system. In this country they are of most frequent

* Annals and Mag. Nat. Hist. ser. 4, vol. vii. p. 112.

† Transactions of the Devonshire Association, 1870.

occurrence in the Chalk near Flamborough Head in Yorkshire, and in the southern and south-western counties. The strata of this age in Westphalia, Hanover, and Brunswick contain large numbers of sponges, which retain their original structure in most beautiful preservation. On the other hand, the Upper Chalk sponges of this country are in a very unfavourable condition of preservation, and it is only in those which have been preserved in the interior of flints that the spicular structure can be satisfactorily ascertained. In the Flamborough forms, as already mentioned, the siliceous spicules are fused together, whilst in the sponges from Surrey, Kent, Sussex, and elsewhere to the South of England, the siliceous skeletons are either replaced by peroxide of iron or completely dissolved away. The following genera of Monactinellids are present in this division—*Reniera*, *Scolioraphis*, *Dirrhopalum*, *Acanthoraphis*, *Opetionella*, and *Cliona*. The Tetractinellid sponges have been referred to the genera *Ophiraphidites*, *Tethyopsis*, *Stelletta*, *Geodia*, *Thenea*, and *Pachastrella*. The Lithistid sponges include the genera *Bolidium*, *Chonella*, *Seliscothon*, *Verruculina*, *Stichophyma*, *Jereica*, *Scytalia*, *Stachyspongia*, *Pachinion*, *Doryderma*, *Heterostinia*, *Carterella*, *Isoraphinia*, *Phymatella*, *Aulaxinia*, *Callopegma*, *Trachysycon*, *Siphonia*, *Jerea*, *Nelumbia*, *Bolospongia*, *Thecosiphonia*, *Calymmatina*, *Turonia*, *Thamnospongia*, *Pholidocladia*, *Ragadinia*, *Plinthosella*, and *Phymaplectia*. The genera of Hexactinellids comprise *Craticularia*, *Verrucocœlia*, *Leptophragma*, *Pleurostoma*, *Guettardia*, *Coscinopora*, *Aphrocallistes*, *Ventriculites*, *Schizorhabdus*, *Rhizopoterion*, *Sporadoscinia*, *Polyblastidium*, *Cephalites*, *Porospongia*, *Cincliderma*, *Plocoscyphia*, *Tremabolites*, *Etheridgia*, *Toulminia*, *Camerospongia*, *Cystispongia*, *Callodictyon*, *Porochonia*, *Becksia*, *Diplodictyon*, *Cœloptychium*, *Stauractinella*, and *Hyalostelia*.

If the siliceous sponges are exceedingly numerous in the Upper Chalk, the calcareous forms, on the other hand, are comparatively rare. In the South of England examples of the genera *Elasmostoma* and *Pharetrospongia* are not uncommon in the Chalk and in flints; and in the Chalk of Maestricht there are species of *Synopella*, *Oculospongia*, and *Elasmostoma*.

Eocene System.—Numerous detached spicules of Monactinellid, Tetractinellid, Lithistid, and Hexactinellid sponges have been discovered by Rutot * in the Eocene Sandstone of Brussels.

Miocene System.—Lithistid and Hexactinellid sponges have been discovered by Pomel † in strata of this age in the Algerian province of Oran, and by Manzoni ‡ in beds of Molasse sandstone in the provinces of Bologna and Modena in Italy. The numerous genera which Pomel has constituted on the characters of the canal-

* Annales de la Société Malacologique de Belgique, tome ix. 1874; and Carter, Ann. and Mag. Nat. Hist. ser. 4, vol. xix. p. 382.

† Description des Animaux fossiles de la Province d'Oran, 5e fascicule, 1872.

‡ La struttura microscopica delle Spugne silicee del Miocene medio, 1882.

structure are quite valueless. Manzoni has referred the Lithistids discovered by him to *Astrocladia*, *Siphonia*, *Jerea*, and *Chenendopora*, and the Hexactinellids to the genus *Craticularia*. Some of these Miocene sponges retain their siliceous structure; in others it has been replaced by calcite.

Classification.

To the obliteration and alteration produced by fossilization in the structure of fossil sponges may be attributed the various conflicting opinions which have been held respecting their characters and the relationship between them and existing forms. It is unnecessary here to refer in detail to these opinions, or to the many ineffectual attempts which have been made to bring the numerous fossil examples of the class into a natural arrangement; it may suffice to state that all the systems of classification, based on differences of external form, or the disposition of the internal canals of the sponge, have proved utterly valueless, and the heterogenous forms grouped together by the advocates of these systems clearly showed their artificial character. The honour of discovering a natural principle of classification for fossil sponges, and thus introducing order where previously a discreditable chaos prevailed, is due to Professor Zittel, who adopted, as a primary basis of classification, the characters of the minute spicular bodies of which the sponge-skeleton is composed. As the result of a thorough microscopic research into the minute structure of most of the known fossil sponges, Zittel brought these forms for the first time into a definite systematic position; so that students of this group have now no difficulty in ascertaining the relative affinity of any specimen which retains even but slight traces of its original structure. The first step in arranging a series of fossil sponges in natural order is to ascertain the characters of the spicular skeleton; and as in the majority of examples no spicular structure is preserved on the outer surface, it is necessary to make a section through the sponge in order to discover, if possible, any indications of structure in the interior. It sometimes happens that all traces of the spicular skeleton have disappeared throughout the central portions of the sponge as well as on the outer surface; and in this case the systematic position of the sponge remains somewhat conjectural. But even when all structure has disappeared from the sponges of certain horizons and localities, we oftentimes find the same sponges from the corresponding strata in other places with their skeletal structures in good preservation. Owing to this fact it is possible to ascertain the original character of many of the sponges from the Upper Chalk of Flamborough and the southern counties of England, in which merely the outer form and canal-structure is retained, by comparing them with the sponges from the same geological horizon in Northern Germany, in which the spicular skeleton remains intact.

The various modifications of the canal-system rank next in importance to the spicular skeleton in affording characters for the minor subdivisions of the sponges;

and, as a rule, these features are more frequently recognizable in fossil examples than the spicular structures.

The following is a list of the different Orders, Families, and Genera in which the fossil sponges referred to in the following pages are arranged. Genera of existing sponges are only included when represented by fossil species.

Class SPONGIÆ.

Division I. **SILICEOUS SPONGES.**

Order MONACTINELLIDÆ.

Climacospongia, *Hinde.*
Lasiocladia, *Hinde.*
Reniera, *O. Schmidt.*
Dirrhopalum, *Ridley.*
Acanthoraphis, *Hinde.*
Spongilla, *Lamarck.*
Cliona, *Grant.*

Order TETRACTINELLIDÆ.

Ophiraphidites, *Carter.*
Tethyopsis, *Zittel.*
Stelletta, *O. Schmidt.*
Geodia, *Lamarck.*
Thenea, *Gray.*
Pachastrella, *O. Sch.*

Order LITHISTIDÆ.

Family RHIZOMORINA.

Cnemidiastrum, *Zittel.*
Corallidium, *Quenst.*
Hyalotragos, *Zitt.*
Pyrgochonia, *Goldf.*
Leiodorella, *Zitt.*
Platychonia, *Zitt.*
Bolidium, *Zitt.*
Chonella, *Zitt.*
Seliscothon, *Zitt.*
Chenendopora, *Lam.*
Verruculina, *Zitt.*
Stichophyma, *Pomel.*
Jereica, *Zitt.*
Scytalia, *Zitt.*
Stachyspongia, *Zitt.*
Pachinion, *Zitt.*

Family MEGAMORINA.

Placonella, *Hinde.*
Doryderma, *Zitt.*
Holodictyon, *Hinde.*
Pachypoterion, *Hinde.*
Heterostinia, *Zitt.*
Nematinion, *Hinde.*
Carterella, *Zitt.*
Isoraphinia, *Zitt.*

Family ANOMOCLADINA.

Cylindrophyma, *Zitt.*
Melonella, *Zitt.*
Lecanella, *Zitt.*
Mastosia, *Zitt.*
Hindia, *Duncan.*

Family TETRACLADINA.

Aulocopium, *Oswald.*
Phymatella, *Zitt.*
Aulaxinia, *Zitt.*
Callopegma, *Zitt.*
Trachysycon, *Zitt.*
Siphonia, *Goldfuss.*
Hallirhoa, *Lamx.*
Jerea, *Lamx.*
Nelumbia, *Pomel.*
Polyjerca, *From.*
Bolospongia, *Hinde.*

Thecosiphonia, ***Zitt.***
Calymmatina, ***Zitt.***
Turonia, ***Mich.***
Kalpinella, ***Hinde.***
Thamnospongia, ***Hinde.***
Pholidocladia, ***Hinde.***
Ragadinia, ***Zitt.***
Plinthosella, ***Zitt.***
Phymaplectia, ***Hinde.***
Rhopalospongia, ***Hinde.***

Order Hexactinellidæ.

Suborder Dictyonina.

Family Astylospongidæ.

Astylospongia, ***Rœmer.***
Palæomanon, ***Rœmer.***

Family Euretidæ.

Tremadictyon, ***Zitt.***
Craticularia, ***Zitt.***
Sphenaulax, ***Zitt.***
Sporadopyle, ***Zitt.***
Strephinia, ***Hinde.***
Verrucocœlia, ***Etallon.***
Stauronema, ***Sollas.***
Sestrodictyon, ***Hinde.***
Brachiospongia, ***Marsh.***

Family Coscinoporidæ.

Leptophragma, ***Zitt.***
Pleurostoma, ***Rœm.***
Guettardia, ***Mich.***
Coscinopora, ***Goldf.***

Family Mellitionidæ.

Aphrocallistes, ***Gray.***

Family Ventriculitidæ.

Pachyteichisma, ***Zitt.***
Trochobolus, ***Zitt.***
Phlyctænium, ***Zitt.***
Ventriculites, ***Mantell.***
Schizorhabdus, ***Zitt.***
Rhizopoterion, ***Zitt.***
Sporadoscinia, ***Pom.***
Sestrocladia, ***Hinde.***
Polyblastidium, ***Zitt.***
Cephalites, ***Toulmin Smith.***

Family Staurodermidæ.

Cypellia, ***Pom.***
Stauroderma, ***Zitt.***
Purisiphonia, ***Bowb.***
Porocypellia, ***Pom.***
Casearia, ***Quenst.***
Porospongia, ***D'Orbigny.***
Ophrystoma, ***Zitt.***
Cincliderma, ***Hinde.***
Protospongia, ***Salter.***
Dictyophyton, ***Hall.***
Eubrochus, ***Sollas.***

Family Meandrospongidæ.

Plocoscyphia, ***Reuss.***
Tremabolites, ***Zitt.***
Etheridgia, ***Tate.***
Toulminia, ***Zitt.***
Camerospongia, ***D'Orbigny.***
Cystispongia, ***Rœmer.***

Family Callodictyonidæ.

Callodictyon, ***Zitt.***
Porochonia, ***Hinde.***
Becksia, ***Schlüter.***
Diplodictyon, ***Zitt.***
Sclerokalia, ***Hinde.***

Family Cœloptychidæ.

Cœloptychium, ***Goldf.***

Suborder Lyssakina, *Zitt.*

Family Monakidæ, *Marshall.*

Astræospongia, ***Rœmer.***
Stauractinella, ***Zitt.***

Family Pollakidæ, *Marshall.*

Hyalostelia, ***Zitt.***
Holasterella, ***Cart.***

Incertæ sedis.

Amphispongia, ***Salter.***

Division II. CALCAREOUS SPONGES.

Order Calcispongiæ, *Blainv.*

Family Pharetrones, *Zitt.*

Eudea, *Lamx.*
Colospongia, *Laube.*
Verticillites, *Defrance.*
Celyphia, *Pomel.*
Himatella, *Zitt.*
Peronella, *Zitt.*
Elasmocœlia, *Rœm.*
Conocœlia, *Zitt.*
Eusiphonella, *Zitt.*
Corynella, *Zitt.*
Myrmecium, *Goldf.*
Lymnorea, *Lamx.*
Stellispongia, *D'Orbig.*
Sestrostomella, *Zitt.*
Blastinia, *Zitt.*
Synopella, *Zitt.*
Oculospongia, *From.*
Crispispongia, *Quenst.*
Elasmostoma, *From.*
Pharetrospongia, *Sollas.*

Family Sycones, *Haeckel.*

Protosycon, *Zitt.*

Class SPONGIÆ.

Division I. **SILICEOUS SPONGES.**

Order MONACTINELLIDÆ, *Zittel.*

Genus CLIMACOSPONGIA, *Hinde*, gen. nov.

Sponges subglobate, sessile, composed of elongate acerate spicules, which radiate upwards from the base to the circumference, and are arranged so as form a closely disposed series of radiating canals, which open at the surface. There are also acerate spicules disposed horizontally so as to cross the vertical spicules at right angles, thus forming an open tissue with rectangular interspaces.

The only fossil sponge with which this genus can be compared is the *Pulvillus Thomsonii*, Carter (Ann. & Mag. Nat. Hist. ser. 5, vol. i. p. 137, t. x. f. 1–6), which is also composed of long acerate spicules; but these do not appear to have the same arrangement, or to be crossed horizontally by other spicules, as in the present genus. The figure given by Carter of the vertical section of *Pulvillus* differs altogether from the vertical section of *Climacospongia.*

CLIMACOSPONGIA RADIATA, *Hinde*, sp. nov. (Plate I. figs. 1, 1*a*.)

The only examples of this sponge in the Museum are portions of two individuals which have been fractured in a vertical direction. The sponges are from 30 to 40 millim. in diameter. They are preserved in a silicified matrix; the exterior is rough and weathered, so as to show the canal-apertures only in a few places. In the vertical section the radiating spicules are in part siliceous, in part replaced by a reddish earthy material, probably iron peroxide; the transverse spicules are mostly replaced by the peroxide, or shown by the impressions in the matrix. The canals are either subangular or circular in section, and 0·75 to 1·5 mm. in width. They are formed and bounded by long acerate spicules, disposed vertically, sometimes in a single series; sometimes two or three spicules are side by side. The ends of the spicules overlap each other, but they do not appear in any way to be attached together. The vertical spicules are straight, or occasionally slightly incurved, and nearly cylindrical. Near the extremities they taper very gradually. Their surfaces appear to be smooth. The longest measured is 3·5 mm. The spicules of the transverse series are not clearly shown in a vertical section; they appear to be of the same character as the vertical spicules, and they cross these latter nearly at right

angles; but their arrangement seems to be irregular, as in some places they are nearly in juxtaposition, whilst in others they are 1 mm. apart.

The appearance of a vertical section of one of these sponges might, at first sight, be easily mistaken for that of a tabulate coral, the vertical spicules representing the walls of the coral, and the transverse spicules the tabulæ. The preservation of the form of this sponge is very remarkable, as there is no indication that the spicules were held together otherwise than by the sarcode. It is possible, however, that other and smaller spicules may have been present; for the large acerates do not completely fill the apertures in the silicified matrix, and some of the reddish material present may be derived from the solution and replacement of smaller spicules.

Distribution. Silurian: Perry County, Tennessee. Judging from the mineral condition of the specimens, they seem to have been derived from the same strata of the Niagara series which have yielded numerous specimens of Hexactinellid sponges belonging to the genera *Astylospongia*, *Astræospongia*, and *Palæomanon*; and it is interesting to discover a true Monactinellid sponge in the same low geological horizon with these forms.

Genus LASIOCLADIA, *Hinde*, gen. nov.

Lasiocladia compressa, *Hinde*, sp. nov. (Plate I. fig. 2.)

The single example of this sponge is of an elongate compressed form, 36 mm. in length by 12 mm. in width, and appears to have formed part of a branching sponge. This fragment is composed of stout, straight, acerate, fusiform spicules, pointed at both ends, which are loosely arranged together in a generally upward and outward direction. Here and there sheaves of spicules project very prominently outwards. The spicules appear to be generally equal in size; the longest measured is 5 mm. by ·25 in width.

The specimen is preserved on the surface of a fragment of olive-green shale. A few spicules only now remain; and these are in the condition of crystalline calcite. The larger portion of the specimen merely shows the empty well defined moulds of the spicules in the shale, which, in the space occupied by the sponge, is of the rusty tint usually present where siliceous spicules have been dissolved.

Distribution. Lower Devonian: Jemelle, Belgium.

Genus RENIERA, *O. Schmidt*, 1862.

Reniera? Carteri, *Hinde*. (Plate I. fig. 8.)

1879. *Spicule ? of a Renierid Sponge,* Carter, Ann. & Mag. Nat. Hist. ser. 5, vol. iii. p. 144, t. 21. f. 11.

Spicules smooth, cylindrical, with rounded obtuse ends; for the most part with a straight central portion, and with both ends sharply incurved, but occasionally gently curved throughout. Average length 1 mm., width ·146 mm.

These spicules retain their siliceous condition; some are crypto-crystalline, others are distinctly crystalline. In these latter the central canal is occasionally preserved. They now occur detached. Mr. Carter regards them as probably allied to existing large-spiculed Renierida: they are very much larger than any existing forms. For the sake of reference I have placed them provisionally under the genus *Reniera*, and associated them with the name of Dr. H. J. Carter, who first described and figured them.

Distribution. Carboniferous Limestone: Dalry, Ayrshire.

Genus DIRRHOPALUM, *Ridley*, 1881.

DIRRHOPALUM PLANUM, *Hinde*, sp.

1880. *Reniera*, sp., Hinde, Foss. Sponge-spicules, p. 21, t. 1. f. 18, 19.

Detached spicules of a conical form, widest at the summits, which are rounded, and gradually tapering to a pointed or blunted extremity. The interior exhibits a relatively large canal of a conical form. The surface appears to have been smooth. In length these spicules vary between 0·495 and 0·852 mm., and the width at the summit from 0·135 to 0·225 mm. Abundant in the interior of flints.

I had referred these spicules to a species of *Reniera*; but Mr. Ridley * has suggested their resemblance to the peg-top spicules of *Dirrhopalum* (*Placomia*) *clopetarium*, O. Schmidt †; and though the fossil spicules are much larger than those of the existing species, the similarity of form may indicate a relationship, and I therefore place them in this genus until more is known of their affinities. Spicules of a similar form, but with tuberculated or spinous surfaces, are also present in the Chalk, and it is at present uncertain whether they belong to the same sponge as the smooth forms. Prof. Sollas has given to the spinous forms the name of *Rhopalocomus tuberculatus* ‡.

Distribution. Upper Chalk: Horstead, North of Ireland; Coesfeld, Westphalia.

Genus ACANTHORAPHIS, *Hinde*, gen. nov.

ACANTHORAPHIS INTERTEXTUS, *Hinde*, sp. nov. (Plate I. figs. 3, 3*a*.)

Sponge apparently of an ovoid shape; the single example is 25 mm. in length by 16 mm. in width. The only structure preserved is a thin delicate surface-tissue with subangular apertures, about 0·75 mm. wide, and porous interspaces between them. This tissue is formed by a layer of straight spicules, superposed over each other in an irregular manner, but not apparently in any way attached to each other. The spicules are fusiform, gradually tapering from the centre to each end; their surfaces are covered with minute blunted spines. They vary somewhat in

* Journ. Linn. Soc. vol. xv. p. 487.

† Spong. Atlant. Gebiet. p. 63, t. 4. f. 18.

‡ Ann. & Mag. Nat. Hist. ser. 5, vol. vi. p. 392.

dimensions; a fairly large spicule measures 2·25 mm. in length by 0·975 mm. in width. The spicules are now composed of iron peroxide.

I am unable to determine whether this delicate film of large spinous spicules constituted the entire skeleton of the sponge, or whether it formed merely the exterior layer of a sponge whose interior skeleton has disappeared. Sufficient remains to show that the form is entirely distinct from any hitherto known. The only specimen is imbedded in soft chalk; it formed part of the Bowerbank collection.

Distribution. Upper Chalk: Shortlands, Kent.

Genus SPONGILLA, *Lam.*, 1816.

SPONGILLA PURBECKENSIS, *Young.* (Plate I. fig. 9.)

1878. *Spongilla purbeckensis,* Young, Geological Magazine, n. s. vol. v. p. 220, figs. *a, b.*

The spicules of this sponge occur in great numbers in nodules or masses of chert; they are slightly curved acerates, fusiform, thickest in the centre, and gradually diminishing to the extremities. According to Mr. Young the spicules are minutely tuberculated; but this feature is not shown in those which have come under my notice. They vary from 0·015 to 0·0255 mm. in width; the longest measured is 0·45 mm.

Some fragments of chert are principally composed of these spicules, which are mingled together without any apparent arrangement. The specimen in the Museum was presented by Mr. Young.

Distribution. In freshwater limestones of the Purbeck series: Stare Cove, Dorset.

Genus CLIONA, *Grant,* 1826.

CLIONA CRETACEA, *Portlock,* sp.

1843. *Entobia cretacea,* Portlock, Geological Report, p. 360.

1808. Parkinson, Organic Remains, t. 8. f. 10.

1851. *Clionites Conybeari,* Morris, Ann. & Mag. Nat. Hist. vol. viii. p. 89, t. 4. f. 8, 9, 10.

The examples of this species now occur as solid, spheroidal, ovate, or depressed elongate siliceous bodies from 1·8 to 5·5 mm. in diameter, which are connected together by numerous stolons into small groups. These bodies are usually found in flints, partially filling the cavities formerly occupied by Belemnites, the tests of Echinoderms, and the shells of *Inoceramus.* The original cavities hollowed out by the boring sponge in these organic bodies have first been filled with silica, so as to form solid moulds of that material; and at a later stage the calcareous material of the shells and tests has been dissolved away, leaving the siliceous infillings intact. These vary considerably in size, and also in their distance from each other; but some of the variations are probably owing to the thickness and character of the shells and

tests in which they have been excavated. In no instance have the spicules of the boring sponge been met with. The examples are numerous. The originals of the figures in the 'Annals,' vol. viii. t. 4. f. 9, 10, are in the Museum collection.

Distribution. Upper Chalk: Norwich, Ventnor, Kent, Surrey. Drift of the Haldon Hills. Miocene: Madeira.

CLIONA GLOMERATA, *Morris*, sp.

1851. *Clionites glomerata*, Morris, Ann. & Mag. Nat. Hist. vol. viii. p. 89, t. 4. f. 11.

This species consists of a single subglobular chamber, about 8·75 mm. in diameter, which has been excavated in the guard of a Belemnite. This chamber is connected with the exterior by two canals, about 2 mm. in width each, as well as by numerous minute thread-like stolons. The original and only specimen is in the Museum collection.

Distribution. Upper Chalk: Norwich.

CLIONA ? MANTELLI, *Wetherell*, sp.

1852. *Clionites Mantelli*, Wetherell, Ann. & Mag. Nat. Hist. vol. x. p. 354, t. 5 *c*. f. 1, 2.

This species is founded on small ovoid cavities in the shell of *Inoceramus*. The cavities have been infilled with silica; and by the dissolution of the shell they now remain as solid bodies, of an ovoid form, 1·25 mm. in length and 1 mm. in depth, disposed either irregularly or in concentric rows following the lines of growth of the shell. There is no indication of any constriction at the aperture of the cavities. The chambers are quite unconnected with each other; the threads of flint which Mr. Wetherell supposed to have been connecting stolons, are in reality nothing more than fibres of silica which have infilled cracks in the shell of the *Inoceramus*. The form of the cavities and their isolation from each other make it very doubtful whether they have been formed by a boring sponge. The original specimens are in the Museum.

Distribution. Upper Chalk: near Bonchurch, Isle of Wight. Drift: Haldon, near Exeter.

CLIONA, sp.

Perforations by boring sponges in the shells of Cretaceous and Tertiary Mollusca; but in the absence of spicules the excavated chambers are not sufficiently characteristic to determine the species.

Distribution. Cretaceous: Pontotoc, Mississippi. Eocene, London Clay: Barton. Miocene: Shurm, Sinaitic Peninsula; Las Palmas, Canary Islands; Porto Praya, Madeira. Red Crag: Walton-on-the-Naze.

Genus TALPINA, *Von Hagenow*, 1840.

The simple tubular borings on which Von Hagenow has constituted this genus differ so much from all those which we know to be produced by boring sponges, that they can hardly be regarded as the work of sponges. The examples of *T. solitaria* and *T. ramosa*, Von Hagenow, figured by Prof. Morris in the Ann. & Mag. Nat. Hist. 1851, vol. viii. t. 4. f. 4, 6 *a*, are in the Museum.

Order TETRACTINELLIDÆ, *Marshall.*

Genus OPHIRAPHIDITES, *Carter*, 1876.

OPHIRAPHIDITES ANASTOMANS, *Hinde*, n. sp. (Plate I. figs. 4, 4 *a*.)

Sponges growing in irregularly shaped masses, composed of loosely disposed tissues which anastomose together. The tissues are from 2 to 4 mm. in width; they are composed of irregularly curved acerate spicules which are, as it were, loosely felted together. Mingled with the curved spicules there are also a few straight forms; but I have been unable to detect any trifid spicules in the general mass. An average large spicule is 2 mm. in length by ·09 mm. in width; spicules of much smaller dimensions are mingled with the larger.

There are two examples which I refer to this species. One, preserved in soft chalk (Plate I. fig. 4), shows, in what is apparently a vertical section, the disposition of the tissues and interspaces of the sponge: the spicules in this example are now replaced by iron-rust; but their forms can be pretty clearly ascertained. The other example is preserved in the interior of a chalk flint, and exhibits a flattened, uneven mass of spicules of the same forms as those of the chalk specimen. From this mass the forms figured (fig. 4 *a*) have been selected.

This species differs from the *Ophiraphidites cretaceus*, Zittel*, in the open locular character of the sponge. The spicules also are generally smaller; and no trifid spicules have been detected. Detached spicules of a similar form to those of this species are very common in the interior of flints from the Upper Chalk of this country, and in strata of the same age in Westphalia and Hanover; they also occur in the Eocene of Brussels; but it is extremely rare to find them still associated together retaining their original positions in the sponge.

It seems somewhat anomalous to include this species in the Tetractinellidæ when no four-rayed spicules have been detected in it; and I can only justify placing it here from the close resemblance of its curved acerates to those of *O. cretaceus*, Zitt., in which trifid spicules are also present, though rarely; and it seems to me not improbable that with more perfect examples they would be found in this form as well.

Distribution. Upper Chalk: South of England.

* Studien, III Ab. p. 8, t. xi. f. 2*a*, *b*, *c*, *d*.

Genus TETHYOPSIS, *Zittel*, 1878.

TETHYOPSIS CRETACEUS, *Hinde*, n. sp. (Plate I. figs. 5, 5 *a*.)

Sponge either compressed or growing in small upright masses of irregular outline, with interpenetrating canals and passages. The sponge-tissues are composed of straight, smooth, acerate spicules, pointed at both ends, and from 2 to 3 mm. in length. Mingled with the acerates are a few simple trifid spicules, with short slightly recurved head-rays. The spicules are disposed generally parallel with each other in close juxtaposition. The surface-characters of the sponge are not preserved.

One example of this species is preserved in the interior of a flint, and displays very clearly the form and arrangement of the spicules. Another specimen is a flattened mass 110 mm. in length, 80 mm. in width, and 16 mm. in thickness, which has been partially dissolved out of the Flamboro' Chalk. This mass appears to be entirely composed of spicules, which, however, are so altered by fossilization as to be scarcely distinguishable.

From *Tethyopsis Steinmanni*, Zitt.*, the only other species of the genus, this form differs in the smaller dimensions of the acerate spicules, and the shorter head-rays of trifid forms.

Distribution. Upper Chalk: Flamboro', Yorkshire; South of England.

Genus STELLETTA, *O. Schmidt*, 1866.

STELLETTA INCLUSA, *Hinde*, n. sp. (Plate I. figs. 6, 6 *a*.)

The only example of this species is preserved in the interior of a chalk flint, and appears to have been originally hemispherical in form. The section shown is 61 mm. in length by 21 mm. in height. The sponge is composed of spicules in close juxtaposition, parallel with each other, and disposed with an outward radial direction.

There are three kinds of spicules present:—1st. Straight, elongated acerates, nearly cylindrical throughout: these do not appear to be very numerous. 2nd. Robust trifid spicules with a straight shaft, which gradually tapers from the head to the pointed extremity; the summit is somewhat flattened, the head-rays are short, simple, somewhat sharply recurved, and with pointed ends. These spicules vary between 2 and 4 mm. in length; an average specimen (2·475 mm. long) has the shaft 0·15 mm. wide, and measures across the head-rays 0·412 mm. The main portion of the sponge is composed of these trifid spicules, which are disposed in a radial direction with the heads towards the exterior. 3rd. Anchor-shaped trifid spicules, with a conical bullet-shaped head, and an elongated cylindrical or very gradually tapering shaft. I have not obtained one of these spicules with an entire

* Studien, III Ab. p. 9, t. xi. f. 3.

shaft, so that I do not know their length. These anchor-shaped spicules appear to be rare in proportion to the other trifids. The surface of the sponge has not been preserved, so that it is doubtful whether it was furnished with disks or stellates.

The only specimen is from Sir P. Egerton's collection.

Distribution. Upper Chalk: England.

Genus GEODIA, *Lam.* 1816.

GEODIA? CLAVATA, *Hinde.*

Geodia? clavata, Hinde, Foss. Sponge Sp. p. 29, t. 2. f. 1–5.

Relatively large, straight, trifid spicules, with short rounded knob-shaped head-rays, either simple or compressed. The shaft constricted at the neck, and immediately below slightly bulbous. Length varying from 7 to nearly 9 mm.; greatest width of shaft 0·585 mm. These spicules have only been found detached in the interior of flints.

Distribution. Upper Chalk: Horstead, Norfolk.

GEODIA? CORONATA, *Hinde.*

Geodia coronata, Hinde, Foss. Sp. Sp. p. 31, t. 2. f. 6–8.

Trifid spicules with small upright head-rays; the shaft is swollen at the summit, and gradually tapers to the extremity. Average length 4 mm.; width of shaft 0·45 mm. These spicules have only been met with detached in the interior of flints.

Distribution. Upper Chalk: Horstead, Norfolk; Kent.

GEODIA? WRIGHTII, *Hinde.*

1880. *Geodia? Wrightii,* Hinde, Foss. Sp. Sp. p. 31, t. 2. f. 12.

Trifid spicules with blunted head-rays projecting forwards from the head of the shaft. Rays and shaft with ring-shaped expansions. Average length 2 mm.; width 0·45 mm. At present they have only been found detached in the interior of flints.

Distribution. Lower Green Sand: Haslemere, Surrey. Upper Chalk: Horstead, Norfolk; South of England; near Belfast (*Wright*); Coesfeld, Westphalia.

Genus THENEA, *Gray,* 1867.

THENEA, sp.

1880. *Tisiphonia?* sp., Hinde, Foss. Sp. Sp. p. 43, t. 3. f. 16–23.

Trifid spicules with widely expanded, usually compound or bifurcate head-rays, which are extended nearly at right angles to the shaft. The shaft varies greatly in length in different specimens; in some instances it is reduced to a mere rounded

central prominence. These spicules have only been found detached; it is probable that they were zone-spicules of one or more species of sponge allied to *Thenea*.

Distribution. Upper Chalk: Horstead, Norfolk; Kent.

Genus PACHASTRELLA, *O. Schmidt*, 1868.

PACHASTRELLA PRIMÆVA, *Zittel.*

1878. *Pachastrella primæva,* Zittel, Studien, III Ab. p. 9, t. xi. f. 4*a, b.*

Microscopic slides with detached spicules of this species. Prof. Zittel's collection.

Distribution. Upper Chalk: Ahlten; Hanover.

PACHASTRELLA CONVOLUTA, *Hinde*, n. sp. (Plate II. figs. 1, 1 *a.*)

Sponge growing in plate-like expansions of various forms and dimensions. It is either fan- or ear-shaped, with rounded incurved margins, or folded so that the lateral margins unite to become vasiform, or the walls are irregularly convolute. Some examples are attached to the surface of other sponges; in others there is no indication of any process by which they were fixed, and these forms may have been free. A large specimen is 110 mm. in length by 100 mm. in width. The walls vary from 7 to 12 mm. in thickness. The surface of the sponge is rough, and frequently uneven. The walls are in places penetrated by tubular apertures; but these are very irregular in size and direction, and appear to be owing rather to extraneous causes than to be of the nature of canals belonging to the sponge.

The walls are entirely composed of quadrifid spicules of various dimensions, loosely mingled together, apparently without definite arrangement, and only held in position by the interlacing of their rays with each other. The spicules of the interior of the walls are only faintly recognizable; but those of the outer and inner surfaces are better preserved, though even these are considerably altered by fossilization. The rays of the spicules are robust, and apparently obtusely pointed. The length of an arm of what appears to be an average spicule is 0·75 mm.

This species may be distinguished from *Pachastrella primæva*, Zitt., by its mode of growth, and also by the dimensions of the spicules, which, so far as I can ascertain, do not reach the size of the larger forms in Zittel's species. In the general form of the spicules, however, and in their disposition this species corresponds with *P. primæva*, and with the existing forms of the genus, *P. abyssi*, O. Schmidt, and *P. intertexta*, Carter*. Detached spicules, apparently resembling those composing this species in form and size, occur in hollow flints at Horstead; but all the examples in which the form of the sponge is retained are from Flamborough, and appear to be not uncommon in the chalk of that locality.

Distribution. Upper Chalk: Flamborough, Yorkshire.

* Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 409, t. xv. f. 41.

PACHASTRELLA PLANA, *Hinde*, n. sp. (Plate I. figs. 7, 7 *a*.)

The only example of this species is contained in the interior of a flint, and is a fragment of the wall of a sponge which appears to have been palmate in form. The wall itself is about 3 mm. in thickness, the margins are attenuated. It is composed of spicules loosely disposed over each other without being attached together. The spicules appear for the most part to be only three-rayed; occasionally, however, a fourth ray is represented by a very short process. The rays of the spicules are straight or slightly arched, nearly in a horizontal plane, and they spring from the centre at nearly equal angles. Two of the three horizontal arms are not infrequently longer than the third. The arms or rays are nearly cylindrical, their ends apparently rounded. The arms vary from 0·6 mm. to nearly 1 mm. in length. The spicules are arranged parallel to the surface of the sponge-wall, so that there are small inter-spaces between the rays.

The form and arrangement of the spicules readily distinguish this from the other described species of *Pachastrella*. Similar spicules to those composing the walls of this species are present detached in the Horstead flint. Foss. Sp. Sp. p. 48, t. iii. f. 27.

Distribution. Upper Chalk: Upware, Cambridgeshire.

Fragments of Flint, Chert, and other Rocks composed of Sponge-spicules.
(Plate I. figs. 10, 11, 12.)

Flint or chert from the Portland Oolite of Upware near Weymouth, containing trifid spicules. Fig. 10 is a magnified representation of a thin microscopic section.

Thin bands of rock from 25 to 75 mm. each in thickness, from the Lower Green Sand near Haslemere in Surrey, are nearly entirely composed of sponge-spicules, which form a compact mass now cemented together in a siliceous matrix. When exposed to the weather the spicules stand out distinctly from the matrix. The spicules are mostly acerates and trifids; a few forms of Lithistid spicules are also present. Fig. 11 is a magnified representation of a minute portion of the weathered surface of one of these sponge-beds. Nodules of rock from the Lower Green Sand of Folkestone and from Badbury Hill near Farringdon are similarly made up of spicules.

Bands of chert in the Upper Green Sands near Ventnor, Isle of Wight, are filled with spicules, which, like those from the Lower Green Sand, are principally acerates and trifids. Fig. 12 is a representation of a thin microscopic section of this chert. Beds and layers of spicules also occur in strata of this age at Blackdown, and in the Haldon Hills near Exeter.

Flints from the Upper Chalk sometimes exhibit spicules imbedded in the siliceous mass; but more frequently the spicules occur infilling cavities in the interior of the

flint nodules. A great variety of forms of trifid and acerate spicules are found commingled together. Rarely, too, in the chalk itself similar spicules are found grouped together; but in this case the spicules are replaced by iron peroxide. Specimens from Norfolk and the south of England.

The spicules which thus occur in enormous numbers in the Oolite, the Lower and Upper Green Sand, and the Upper Chalk are principally of Tetractinellid sponges, and resemble those of the existing genera *Geodia*, *Tethya*, *Stelletta*, &c.; but their forms are not sufficiently characteristic to allow a generic or specific determination to be made from them.

Order LITHISTIDÆ, *O. Schmidt.*

Family *RHIZOMORINA*, Zittel.

Genus CNEMIDIASTRUM, *Zittel*, 1878.

CNEMIDIASTRUM STELLATUM, *Goldf.* sp.

1833. ***Cnemidium stellatum***, Goldfuss, Petref. Th. 1, p. 15, t. 6. f. 2.
1833. ***Cnemidium granulosum***, Münst., Goldf. Petref. p. 97, t. 35. f. 7.
1878. ***Cnemispongia Goldfussi***, Quenst. Petref. Bd. 5, p. 259, t. 126. f. 73, 74, and t. 127. f. 1–16.
1878. ***Cnemidiastrum stellatum***, Zitt. Studien, II Ab. p. 46, t. 3. f. 1, 2.
1879. ***Cnemidiastrum stellatum***, Zitt. Handbuch der Palæont. Bd. 1, p. 150, f. 66.

Distribution. Upper Jura: Randen, Heuberg; Würtemberg.

CNEMIDIASTRUM STRIATO-PUNCTATUM, *Goldf.* sp.

1833. ***Cnemidium striato-punctatum***, Goldf. Petref. Th. 1, p. 15, t. 6. f. 3.
1878. ***Cnemispongia Goldfussi***, Quenst. p. p. Petref. Bd. 5, p. 268, t. 127. f. 19–22.
1878. ***Cnemidiastrum striato-punctatum***, Zitt. Stud. II Ab. p. 46.

Distribution. Upper Jura: Randen, Heuberg; Würtemberg.

CNEMIDIASTRUM CORALLINUM, *Quenst.* sp.

1858. ***Cnemidium corallinum***, Quenst. Der Jura, p. 694, t. 84. f. 1.
1878. ***Cnemidium corallinum***, Quenst. Petref. Bd. 5, p. 267, t. 127. f. 16–18.
1878. ***Cnemidiastrum corallinum***, Zitt. Stud. II Ab. p. 46.

Distribution. Upper Jura: Randen.

CNEMIDIASTRUM HOHENEGGERI, *Zitt.*

1878. ***Cnemidiastrum Hoheneggeri***, Zitt. Stud. II Ab. p. 46, t. 2. f. 8.

Microscopic slides with the spicules of this species, from Zittel's collection.
Distribution. Upper Jura: Wodna, Cracow.

CNEMIDIASTRUM RIMULOSUM, *Goldf.* sp.

1833. *Cnemidium rimulosum,* Goldf. Petref. Th. 1, p. 15, t. 6. f. 4.
1878. *Cnemidium rimulosum,* Quenst. Petref. Bd. 5, p. 271, t. 128. f. 1–5.
1878. *Tragos granulosum,* Quenst. Petref. Bd. 5, p. 285, t. 129. f. 4, 5.
1878. *Cnemidiastrum rimulosum,* Zitt. Stud. II Ab. p. 46, t. 3. f. 3.

Distribution. Upper Jura: Randen; Würtemberg.

CNEMIDIASTRUM PLURISTELLATUM, *Zitt.*

1878. *Cnemidiastrum pluristellatum,* Zitt. Stud. II Ab. p. 46.
1833. *Cnemidium stellatum,* Goldf. Petref. Th. 1, p. 15, t. 30. f. 3.
1858. *Cnemidium stellatum,* Quenst. (non Goldf.) Jura, p. 676.
1878. *Cnemidium stellatum,* Quenst. Petref. Bd. 5, p. 272, t. 128. f. 6, 7.

Distribution. Upper Jura: Randen, Heuberg; Würtemberg.

Genus CORALLIDIUM, *Zittel*, 1878.

CORALLIDIUM DICERATINUM, *Quenst.* sp.

1852. *Cnemidium diceratinum,* Quenst. Handb. t. 61. f. 20.
1878. *Cnemidium diceratinum,* Quenst. Petref. Bd. 5, p. 275, t. 128. f. 10–12.
1878. *Corallidium diceratinum,* Zitt. Stud. II Ab. p. 46.

Distribution. Upper Jura: Kelheim, Bavaria (*Zittel's coll.*).

Genus HYALOTRAGOS, *Zittel*, 1878.

HYALOTRAGOS PATELLA, *Goldf.* sp.

1833. *Tragos patella,* Goldf. Petref. Th. 1, pp. 14, 96, t. 5. f. 10, and t. 35. f. 2.
1878. *Tragos patella,* Quenst. Petref. Bd. 5, p. 283, t. 128. f. 26–28, and t. 129. f. 1–3.
1878. *Hyalotragos patella,* Zitt. Stud. II Ab. p. 47, t. 3. f. 4, 5.

Distribution. Upper Jura: Hossingen, Heuberg; Würtemberg.

HYALOTRAGOS RADIATUM, *Goldf.* sp.

1833. *Tragos radiatum,* Goldf. Petref. Th. 1, p. 96, t. 35. f. 2.
1878. *Tragos radiatum,* Quenst. Petref. Bd. 5, p. 281, t. 128. f. 24, 25.
1878. *Hyalotragos radiatum,* Zitt. Stud. II Ab. p. 48.

Distribution. Upper Jura: Randen, Böhringen.

HYALOTRAGOS RETICULATUM, *Münst.* sp.

1833. *Tragos reticulatum,* Münst., Goldf. Petref. Th. 1, p. 96, t. 35. f. 5.
1878. *Tragos reticulatum,* Quenst. Petref. Bd. 5, p. 289, t. 129. f. 10–15.
1878. *Hyalotragos reticulatum,* Zitt. Stud. II Ab. p. 48.

Distribution. Upper Jura: Randen, Heuberg; Würtemberg.

HYALOTRAGOS RUGOSUM, *Münst.* sp.

1833. *Tragos rugosum,* Münst. Petref. Th. 1, p. 96, t. 35. f. 4.
1878. *Hyalotragos rugosum,* Zittel, Stud. II Ab. p. 48.

Distribution. Upper Jura: Streitberg.

HYALOTRAGOS PEZIZOIDES, *Goldf.* sp.

1833. *Tragos pezizoides,* Goldf. Petref. Th. 1, p. 13, t. 5. f. 8.
1878. *Tragos fistulosum,* Quenst. Petref. Bd. 5, p. 278, t. 128. f. 15–23.
1878. *Hyalotragos pezizoides,* Zitt. Stud. II Ab. p. 48.

Distribution. Upper Jura: Randen, Heuberg; Würtemberg.

Genus PYRGOCHONIA, *Zitt.* 1878.

PYRGOCHONIA ACETABULUM, *Goldf.* sp.

1833. *Tragos acetabulum,* Goldf. Petref. Th. 1, p. 13, t. 5. f. 9.
1833. *Tragos verrucosum,* Münst., Goldf. Petref. Th. 1, p. 96, t. 35. f. 6.
1878. *Tragos acetabulum,* Quenst. Petref. Bd. 5, p. 288, t. 129. f. 7, 8, 18.
1878. *Tragos infranudatum,* Quenst. ib. ib. p. 287, t. 129. f. 6.
1878. *Pyrgochonia acetabulum,* Zitt. Stud. II Ab. p. 48.

Distribution. Upper Jura: Randen, Heuberg.

Genus LEIODORELLA, *Zitt.* 1878.

LEIODORELLA EXPANSA, *Zitt.*

1878. *Leiodorella expansa,* Zitt. Stud. II Ab. p. 49, t. 2. f. 5, and t. 3. f. 11.

Distribution. Upper Jura: Wodna, Cracow (*Zittel's coll.*).

Genus PLATYCHONIA, *Zitt.* 1878.

PLATYCHONIA AURIFORMIS, *Quenst.* sp.

1878. *Spongites auriformis,* Quenst. Petref. Bd. 5, p. 319, t. 131. f. 1.
1878. *Platychonia auriformis,* Zitt. Stud. II Ab. p. 50, t. 3. f. 9.

Distribution. Upper Jura: Streitberg, Nattheim.

PLATYCHONIA VAGANS, *Quenst.* sp.

1858. *Spongites vagans,* Quenst. Jura, t. 82. f. 8.
1878. *Platychonia vagans,* Zitt. Stud. II Ab. p. 50, t. 3. f. 8.

Microscopic slides with spicules of this species (*Zittel's coll.*).
Distribution. Upper Jura: Streitberg.

PLATYCHONIA, sp.

Distribution. Upper Jura: Wurgau, Franconia (*Zittel's coll.*).

Genus BOLIDIUM, *Zitt.* 1878.

BOLIDIUM PALMATUM, *Rœmer*, sp.

1864. *Amorphospongia palmata,* Rœmer, Palæont. Bd. 13, p. 55, t. 19. f. 8.

Microscopic slide with spicules of the species.
Distribution. Upper Chalk: Sudmerberg; Goslar.

Genus CHONELLA, *Zitt.* 1878.

CHONELLA TENUIS, *Rœmer*, sp.

1864. *Cupulospongia tenuis,* Rœmer, Palæont. Bd. 13, p. 51, t. 17. f. 7.
1878. *Chonella tenuis,* Zitt. Stud. II Ab. p. 52, t. 3. f. 6, 7.

Distribution. Upper Chalk: Sudmerberg, Biewende; Brunswick.

CHONELLA AURIFORMS, *Rœmer*, sp.

1840. *Achilleum auriformis,* F. A. Rœmer, Nordd. Kreide. p. 2, t. 1. f. 3.
1878. *Chonella auriformis,* Zitt. Stud. II Ab. p. 52.

Distribution. Neocomian: Berklingen, Brunswick.

Genus SELISCOTHON, *Zitt.* 1878.

SELISCOTHON PLANUS, *Phillips*, sp. (Plate II. figs. 2–4.)

1835. *Spongia plana,* Phill. Geol. of Yorkshire, p. 177, t. 1. f. 1.
1835. *Spongia capitata,* Phill. ib. p. 177, t. 1. f. 2.
1878. *Seliscothon planus* et *capitatus,* Zitt. Stud. II Ab. p. 54.

Sponge similar in form to an expanded mushroom. The body or upper portion is plate-like, circular in outline, usually with a slight central depression immediately above the stem. The upper surface sometimes shelves gradually from the margin to the centre; more frequently, however, it is nearly flat or even slightly convex. The margins are usually oblique, and form nearly a right angle with the under surface. The lower surface is flat or slightly concave. The stem is inversely conical in form, and gradually tapers to a blunted extremity. There are no indications of its attachment to a foreign body. It varies in length in different examples; an average specimen measures 55 mm. Small examples of the species are not more than 27 mm. in width, whilst large forms reach up to 190 mm. The thickness of the body-plate varies between 10 and 14 mm.

The upper surface of the body is thickly covered as far as the marginal edge with circular apertures ·75 to 1 mm. in width; in specimens treated with acid these openings appear to be oblique to the plane of the surface. The under surface of the body in the best-preserved specimens seems to be composed of a close dermal layer, which, however, is usually absent, and then the vertical lamellæ are exposed.

The sponge itself is composed of a series of delicate fibrous lamellæ extending from the centre to the circumference, having a general resemblance to the septa of corals. These lamellæ are about 0·4 mm. in thickness and about 1 mm. apart. Numerous interstitial fibres connect the radial lamellæ, so that the aspect of a vertical section of the sponge-wall is that of a labyrinthine fibrous web. In all the specimens the spicules forming the fibres have been so fused together that the individual forms cannot be detected.

As no description whatever accompanies the figures of the sponges from the Flamborough Chalk given by Phillips in the 'Geology of Yorkshire,' and as the figures are very imperfectly drawn, it is often a matter of great difficulty to determine the forms which they are supposed to represent. Judging by the representation of *Spongia capitata*, plate 1. fig. 2, it would appear to possess but slight relationship with the *Spongia plana* (fig. 1). In reality, however, the only difference between the sponges thus designated consists in the outer form; the summit of *S. capitata* has not been developed to the same extent as that of *S. plana*. The examples in the Museum collection show a series of gradational forms between those in which the summit of the sponge is scarcely more expanded than the top of the stem, and those with very widely expanded bodies; and there can be little doubt that Phillips's *S. capitata* should be included in the same species as the *S. plana*.

This species seems to be the most common of any of the Flamborough sponges, but it does not appear to have been recognized from any other locality in the English Chalk.

Distribution. Upper Chalk: Flamborough, Yorkshire.

SELISCOTHON EXPLANATUS, *Rœmer*, sp. (Plate II. fig. 5.)

1864. *Chenendopora explanata,* Rœmer, Palæont. Bd. 13, p. 44, t. 16. f. 3.
1878. *Seliscothon explanatus,* Zitt. Stud. II Ab. p. 54, t. 4. f. 2.

Body of sponge forming a flat plate-like expansion, apparently circular in outline. No stem has been preserved. The upper surface has a few concentric, slightly marked, rounded ridges. The margins rounded. The only specimen is a portion of a sponge, about 180 mm. in width across the summit and 5 mm. in thickness.

The upper surface is furnished with a dermal membrane in which are numerous irregularly disposed circular apertures 0·75 mm. in width, and from two to three diameters apart. The under surface appears to be entirely covered with the dermal membrane.

The vertical lamellæ are 0·3 mm. in width and about 0·5 mm. apart. These lamellæ are formed of extremely delicate, elongated branching and spinous spicules, which are interlocked together. In the Flamborough specimen these spicules are undistinguishable; those figured are from a specimen from Hanover.

The only example from Flamborough differs from the type of Rœmer in possessing rounded margins and a somewhat thinner plate, but resembles it in form, in the size of the apertures of the upper surface, and in the furrowed dermal layer. From *S. planus* this species is readily distinguished by its furrowed upper surface, the smaller and less closely disposed apertures, and the more delicate character of the vertical lamellæ.

Distribution. Upper Chalk: Flamborough, Yorkshire; Ahlten, Hanover (*Zittel's coll.*).

SELISCOTHON MANTELLI, *Goldf.* sp.

1833. *Scyphia mantelli,* Goldfuss, Petref. Th. 1, p. 219, t. 65. f. 5.
1878. *Scyphia mantelli,* Quenst. Petref. Bd. 5, p. 375, t. 133. f. 4.
1878. *Seliscothon mantelli,* Zitt. Stud. II Ab. p. 54, t. 4. f. 3.

Microscopic slides with spicules of this species.

Distribution. Coesfeld, Westphalia.

SELISCOTHON TESTA-FLORUM, *Quenst.* sp.

1878. *Scyphia testa-florum,* Quenst. Petref. Bd. 5, p. 377, t. 135. f. 7.

Distribution. Upper Chalk: Sudmerberg.

SELISCOTHON GIGANTEUS, *Rœmer*, sp.

1864. *Cupulospongia gigantea,* Rœmer, Palæont. Bd. 13, p. 51, t. 18. f. 1.
1878. *Seliscothon giganteum,* Zitt. Stud. II Ab. p. 54, t. 4. f. 4.

Distribution. Craie Chloritée: Vaches Noires, Havre.

SELISCOTHON, sp.

Distribution. Upper Chalk: Sudmerberg; Goslar.

Genus CHENENDOPORA, *Lamx.*, 1821.

CHENENDOPORA FUNGIFORMIS, *Lamx.*

1821. *Chenendopora fungiformis,* Lamx. Expos. méthod. des genres de l'ordre des polypiers, p. 77, t. 75. f. 9, 10.
1808. *Funnel-formed Alcyonite,* Parkinson, Org. Rem. vol. ii. t. 11. f. 5.
1847. *Chenendopora fungiformis,* Michelin, Icon. Zooph. p. 130, t. 34. f. 3.
1861. *Bicupula lata,* Courtiller, Eponges fossiles, p. 139, t. 37. f. 1.
1878. *Chenendopora fungiformis,* Zitt. Stud. II Ab. p. 55, t. 3. f. 13, 14.

There are typical examples of this species in the Museum from the Craie of Vaches Noires, near Havre, but only a single specimen from the Upper Green Sand of Warminster, which I refer with some doubt to this species; for there are no traces of the wrinkled dermal layer, and the margins of the cup are rounded, and not flattened as in the French examples. The spicular structure, however, appears to resemble that of the typical forms; and I therefore leave it provisionally under this species. According to Prof. Zittel the French examples are derived from the Upper Chalk, or Senon of D'Orbigny; but I have not met with any from the same horizon in England.

Distribution. Upper Green Sand: Warminster. Upper Chalk (Senon): Vaches Noires, near Havre.

CHENENDOPORA MICHELINII, *Hinde*, sp. n. (Plate III. figs. 1, 1 *a*, 1 *b*.)

Sponges simple, with vasiform or cup-shaped bodies which gradually taper below to an elongated cylindrical or compressed stem, which occasionally bifurcates in its lower portion. The walls of the cup or vase are sometimes smooth and even, sometimes with longitudinal open folds; the margins are usually thin, rounded, and occasionally with a slight inward or outward curve. There is a considerable variation in the thickness of the cup-walls in different specimens; the vasiform examples range from 5 to 6 mm. in thickness, whilst the cup-shaped forms are even 9 mm. thick. The stem is usually simple, but at its lower portion it either divides into root-like extensions or becomes expanded into a hollow disk. In large specimens the stem measures 260 mm. in length by 46 mm. in thickness; and the width of the sponge at the summit varies in different examples between 55 mm. and 170 mm.

Both the exterior and interior surfaces of the cup are furnished with numerous openings of canals about 0·85 mm. in width, and apparently similar on both surfaces. The stems when weathered exhibit longitudinal branched canals.

The spicules are irregular branching bodies, covered with rounded tubercles, which interlock and connect them with each other. They are so intimately interwoven together that in a thin microscopic section it is difficult to distinguish the individual forms. Occasionally a sinuous canal can be seen in the axial line of the spicule. The spicules are 0·042 mm. in thickness.

The sponges which I refer to this species are not uncommon in the Upper Green Sand of Wiltshire. There is a considerable variety of form and dimensions in the different examples; but I cannot discover any characters which would allow them to be placed under more than a single species. They seem to have been generally referred to the *Polypothecia infundibulum*, Benett; but in the figure of this species three or four cup-shaped sponges are represented as growing closely aggregated together, whilst *C. michelinii* is uniformly simple. In the absence of any description

of Miss Benett's species, I am unable to compare it with the present one in other characters.

The sponge figured in the frontispiece of the second volume of Parkinson's 'Organic Remains' is in the Museum collection, and appears to belong to this species; but without making a section of it, I cannot satisfactorily determine the point. The specimen is stated by Parkinson (*l. c.* p. 125) to have been found in Wiltshire; but its appearance differs so much from all the other examples from this county, that it seems to me to have been brought from some other locality, probably France.

Michelin has figured a sponge under the name of *Chenendopora Parkinsonis*, Icon. Zooph. p. 131, t. 31. f. 1, which in outer form very closely resembles some of the examples of *C. Michelinii*; but it differs in having numerous canal-apertures on the flattened margins of the cup. Zittel has referred this form to the genus *Margino-spongia*, D'Orbigny, and placed it in the Tetracladina family. Its spicular structure, however, does not yet appear to have been ascertained.

Distribution. Upper Green Sand: Warminster; Vaches Noires?

CHENENDOPORA POCILLUM, *Michelin.*

1847. *Chenendopora pocillum,* Mich. Icon. Zooph. p. 132, t. 33. f. 5.
1861. *Cupulina pocillum,* Court. Epong. Foss. p. 18, t. 29. f. 1.
1861. *Cupulina elata,* Court. ib. p. 18, t. 29. f. 2.
1878. *Chenendopora pocillum,* Zitt. Stud. II Ab. p. 55.

Distribution. Craie Chloritée?: France (*Bright collection*).

Genus VERRUCULINA, *Zitt.*, 1878.

Professor Zittel includes in this genus fan, palmate, or funnel-shaped sponges, with projecting oscules on the upper or inner surface of the wall, and with small pore-like openings on the lower or outer surface. For sponges similar in form, but with oscules on both the upper and lower wall-surfaces, Zittel constituted the genus *Amphithelion*, but at the same time acknowledges that the differences between it and *Verruculina* are hardly more than of subgeneric importance. In practice, however, I find that these differences are very difficult of application; for though in typical forms the distinction between the oscules of the upper and the pores of the lower surface of the sponge is sufficiently clear, there are many examples in which it is difficult to determine whether the canal apertures of the lower surface have the characters of pores or oscules. I therefore propose to relinquish the genus *Amphithelion* and to include the sponges placed therein in the genus *Verruculina*. The definition of this latter genus will thus have to be extended so as to embrace

sponges which, in addition to the projecting oscules on the upper surface, are furnished either with pores or oscules on the lower surface of the wall.

There are very numerous examples of this genus in the Upper Chalk of Flamborough and in the Middle and Upper Chalk of Germany and Bohemia. They are all similar in their mode of growth, but present distinct specific characters in the dimensions and disposition of the canal-apertures of the upper and lower surfaces of the wall, as well as in the thickness of the wall itself. I have found it a very difficult task to identify any of the Flamborough examples with the figures given by Phillips of the sponges from this locality; for though there can be little doubt that he has intended to represent one or more species of this genus, the figures given are so imperfect in detail that, in the absence of any description, it is impossible to recognize the species which they are supposed to indicate. For example, the *Spongia marginata*, Phill. Geol. York. pl. i. fig. 5, belongs undoubtedly to the genus *Verruculina*; but later authors, such as Reuss, Rœmer, and Quenstedt, have each relegated different forms of sponges to Phillips's name, thus clearly showing the insufficiency of his figure to establish the species. A somewhat similar difficulty exists in respect to some of the species of this genus described by F. A. Rœmer from the North-German Chalk; for the descriptions are generally so meagre that they would apply to more than one species.

It is only with reluctance that I have added four new species to the number already included in this genus; but it seemed preferable to do this, than to place the examples under specific names which have no definite characters assigned to them.

VERRUCULINA SERIATOPORA, *Rœmer*, sp. (Plate III. fig. 4.)

1840. *Manon seriatoporum*, F. A. Rœmer, Nordd. Kreide. p. 3, t. 1. f. 6.
1878. *Verruculina seriatopora*, Zitt. Stud. II Ab. p. 59, t. 4. f. 1.

There is a fragment of a sponge in the collection which I refer, though not without doubt, to the above species. The wall of the specimen is from 8 to 11 mm. in thickness; the upper surface is furnished with projecting oscules, 2 mm. in diameter near their bases, partly disposed in linear order. The lower surface appears to be composed of closely interwoven fibres; but it is not sufficiently free from the matrix to show if pores are present or not. The spicules of which the fibres of this species are made up are minute irregularly branching bodies with spinous projections on their surfaces.

Distribution. Upper Chalk: Sudmerberg; Ahlten (*Zittel's coll.*).

VERRUCULINA PLICATA, *Hinde*, n. sp. (Plate IV. figs. 2, 2 *a*, *b*, *c*, *d*.)

Sponges with plate-like walls, usually incurved, and occasionally, by the meeting and union of the lateral margins, becoming open funnel-shaped. In a few specimens the walls extend in a horizontal direction, and the sponge is platter-shaped. The

walls are from 6 to 9 mm. in thickness. The margins are somewhat attenuated and rounded; and the oscules extend close to the edge of the wall. The examples are of various dimensions, a large specimen measuring 170 mm. in width.

The upper or inner wall-surface has numerous, irregularly disposed, slightly projecting oscules, 0·65 mm. wide, and about 2 mm. apart; the interspace between the oscules appears to be composed of a compact membrane when perfect; but usually it exhibits closely arranged sinuous apertures. The lower or outer wall-surface is roughened occasionally with shallow concentric furrows, and is traversed by thickset minute pores, 0·3 mm. each in width. In many examples the lower surface has the appearance of a compact membrane; but when treated with dilute acid the pores become visible.

Traces of the spicules can be occasionally seen; but, as a rule, the spicular fibres are destroyed, and the interior of the sponge-wall exhibits only a mass of porous silica.

From *Verruculina aurita*, Rœm. sp., Palæont. Bd. 13, p. 43, t. 16. f. 2, this species is distinguished by the more numerous oscules on the upper surface, and the very closely set pores on the lower, whilst the margins are not thickened as in Rœmer's species. It differs from *V. seriatoporum*, Rœm. sp., in the absence of a linear arrangement and the smaller size of the oscules, and also by the pores of the under surface. The *V. Phillipsii*, Reuss, sp., Boh. Kr. p. 77, t. 19. f. 7, has much stouter walls, and there no pores on the lower surface. It seems probable that Reuss has included more than one species under *V. Phillipsii*; for his fig. 9 has very much thinner walls than fig. 7, and the oscules are not more than half the size.

V. plicata appears to have been abundant.

Distribution. Upper Chalk: Flamborough; Sudmerberg.

VERRUCULINA ASTRÆA, *Hinde*, n. sp. (Plate III. figs. 5, 5 *a*.)

Sponges fan-, cup-, or ear-shaped, with walls from 4·5 mm. to 6·5 mm. in thickness. The margins rounded and of the same thickness as the wall. The specimens vary from 40 to 70 mm. in lateral extension, and reach to 70 mm. in height.

The inner surface of the wall has irregularly disposed projecting oscules, each about 0·7 mm. in width. From each of these oscules sinuous canals radiate in all directions. These canals extend apparently in a horizontal direction immediately beneath the dermal layer. The under and outer surface of the wall has, in some specimens, slight concentric ridges and furrows; it is covered with a dermal layer which is pierced by minute pore-like apertures 0·3 mm. in width, which are either irregularly scattered on the surface or disposed in reticulating lines.

This species approaches *V. plicata*, but is distinguished from it by the radial disposition of the canals round the oscules, and the irregular arrangement of the pores of the under surface. The walls are also thinner. In the general form and dispo-

sition of the oscules this species also resembles *V. miliaris*, Reuss, but is readily distinguished therefrom by the different characters of the under surface.

Distribution. Upper Chalk: Flamborough.

VERRUCULINA CONVOLUTA, *Quenst.* sp. (Plate IV. figs. 1, 1 *a*, *b*, *c*, *d*.)

1878. *Spongia convoluta,* Quenst. Petref. Bd. 5, p. 368, t. 132. f. 49, 50.
1835. *Spongia convoluta ?,* Phill. Geol. York. t. 1. f. 6.
1870. *Chenendopora tenuis,* p. p., F. Rœmer, Geol. Oberschl. p. 301, t. 31. f. 1.
1878. *Amphithelion convoluta,* Zitt. Stud. II Ab. p. 60.

Sponge consisting of a convoluted plate, which by the union of the lateral margins frequently becomes open funnel-shaped. The wall is nearly 7 mm. in thickness, the margins rounded, and slightly thinner than the wall. Large specimens measure 115 mm. in width at the summit and 100 mm. in height.

Both the outer and inner surfaces of the sponge-wall are thickly covered with minute apertures, varying from 0·3 to 0·5 mm. in width. Those of the upper or inner surface have very slightly elevated margins, and are somewhat further apart than those of the outer surface. These latter appear generally not to possess raised margins, though in some cases they are present. The canal-structures of the interior, as also the spicular fibre, have been completely obliterated in all the specimens.

In general form, thickness of the wall, and the characters of the outer surface these sponges resemble the *V. convoluta,* Quenst.; but in Quenstedt's examples the features of the inner surface had been obliterated, and I can only suppose that they were originally similar to these forms. The figure given by Phillips of *Spongia convoluta,* loc. cit. t. 1. f. 6, is altogether insufficient for recognition, and might be applicable to two or three species of these Flamborough forms. F. Rœmer has figured a sponge under the name of *Chenendopora tenuis,* loc. cit. t. 31. f. 1, which resembles the present form very closely; and if there had been any certainty that this figure really represented the original type of his brother's species, that name would have had the priority. But judging from the figures and descriptions given by F. A. Rœmer himself in the 'Nordd. Kreide' and in the 'Palæontographica,' there is but little resemblance to the specimen figured by F. Rœmer in the 'Geol. Oberschl.' t. 31. f. 1. The identity of *Chenendopora tenuis* becomes still more doubtful from the fact that the second figure given of it by F. Rœmer, Geol. Oberschl. t. 31. f. 3, appears to belong to a different species from the fig. 1 of the same plate.

The similarity of the apertures on both surfaces of the wall and their small dimensions very readily distinguish this from the other species of this genus.

Distribution. Upper Chalk: Flamborough.

VERRUCULINA PUSTULOSA, *Hinde*, n. sp. (Plate III. figs. 2, 2 *a*.)

1845. ***Manon miliare***, Reuss, p. p., Böhm. Kreide. p. 78, t. 19. f. 13.

1864. ***Chenendopora tenuis***, F. A. Rœmer, p. p., Palæont. Bd. 13, t. 15. f. 4, non ***Manon tenue***, F. A. Rœm. Nordd. Kreide, t. 1. f. 7.

Sponges wide funnel-shaped, formed by a convoluted plate, which generally overlaps at the margins. The walls are from 4 to 5 mm. in thickness; the margins are rounded and of the same thickness as the walls. An average specimen is 64 mm. in width at the summit, and 42 mm. in height.

The upper or inner surface is covered with small projecting oscules 0·5 mm. in width, disposed in horizontal lines about 1 mm. apart. The oscules have thickened, slightly projecting margins, and are about their own diameter from each other. The under surface has similar but slightly smaller oscules, disposed either irregularly or in sinuous lines.

There are several examples in the collection which have the same distinguishing features, and thus appear to belong to a distinct species, characterized by thin walls, the regular horizontal disposition of the oscules of the inner surface of the walls, and the closely arranged oscules of the outer surface. The examples of this species are also, as a rule, smaller than those already described. Reuss has figured (*loc. cit.* t. 19. f. 13) a fragment of a specimen of this species, and included it in his *Manon miliare*; but there is clearly a specific difference between this and the other forms (figs. 10, 11) which he has placed under this name. The *Chenendopora tenuis*, figured by F. A. Rœmer in the 'Palæontographica' (*l. c.* f. 4), has the same disposition of the oscules of the inner surface as the present form; but it is different from the figure of the original type of his species in the 'Nordd. Kreide' (*l. c.* f. 7), to which alone the name should be applied.

Distribution. Upper Chalk: Flamborough.

VERRUCULINA MILIARIS, *Reuss*, sp. (Plate III. figs. 3, 3 *a*.)

1846. ***Manon miliare***, Reuss, p. p., Böhm. Kreide. p. 78, t. 19. f. 10–12.

1878. ***Amphithelion miliare***, Zittel, Stud. II Ab. p. 60.

Sponges fan-shaped, or, by the coalescence of the incurved margins, becoming funnel-shaped. The margins rounded, and of the same thickness as the walls. In some examples the margins are extended into finger-like projections. The walls are from 5 to 8 mm. in thickness. The largest specimen in the collection is 100 mm. wide at the summit, and 98 mm. in height.

The upper or inner surface with sparsely scattered oscules 1·2 mm. wide, which strongly project, obliquely upwards, from the surface. The apertures of the lower surface of the wall are 0·5 mm. in width, with slightly projecting margins; they are about their own diameter apart, and not infrequently disposed in sinuous lines. The spicular structure and the interior canals are destroyed in all the specimens.

The Flamborough examples have the oscules of the upper surface more projecting and less numerous than in Reuss's figure 11 *a*, which I take as the typical form of the species; as, however, the similarity in other respects is very close, I did not regard the difference in this feature as of sufficient importance to place them as a new species. Reuss states in his description of this species that the openings of the outer surface are larger and more projecting than those of the inner surface; but a glance at his figures plainly shows that the surface which he terms "outer" is in reality, in the case of the funnel-shaped specimens, the inner surface. From the *V. aurita*, F. A. Rœmer *, this form is distinguished by the projecting apertures of the under surface.

Distribution. Upper Chalk: Flamborough.

VERRUCULINA REUSSII, *M'Coy*, sp. (Plate V. figs. 1, 1 *a*.)

1848. *Manon Reussii,* M'Coy, Ann. & Mag. Nat. Hist. vol. ii. p. 398.
1878. *Manon circumporosum,* Quenst. Petref. Bd. 5, p. 372, t. 132. f. 55.

Sponge forming large horizontal plate-like expansions, or in the form of a shallow dish or cup, growing from a short peduncle. The margins are rounded, either even, lobed, or occasionally digitate. The thickness of the wall is from 10 to 12 mm. A large example measures 190 mm. in width.

Both surfaces of the sponge-wall possess a thickened dermal layer. The oscules are carried on the summits of small papillæ; they are 1·75 mm. in width each, and are disposed irregularly on both surfaces, from one to three diameters apart. The oscules of the under surface are somewhat less projecting than those of the upper, but they are nearly equal as regards size.

The interior of the wall is composed of a labyrinthine web of very delicate anastomosing fibres; there are no indications of distinct canals. The spicules composing the fibre cannot be distinguished.

The thickness of the walls and the large size of the oscules on both surfaces readily characterize this species. No figure accompanied M'Coy's description; but there is no difficulty in recognizing the species from his description. The example figured by Quenstedt under the name of *Manon circumporosum* appears to belong to this species.

The examples are numerous and well preserved.

Distribution. Upper Chalk: Flamborough.

VERRUCULINA MACROMMATA, *Rœm.* sp.

1864. *Verrucospongia macrommata,* Rœmer, Palæon. Bd. 13, p. 45, t. 16. f. 4.
1878. *Amphithelion macrommata,* Zitt. Stud. II Ab. p. 60, t. 3. f. 15.

Microscopic slide with detached spicules of this species.

Distribution. Upper Chalk: Ahlten, Hanover.

* Palæontographica, Bd. 13, p. 43, t. 16. f. 2.

VERRUCULINA PAPILLATA, *Hinde*, n. sp. (Plate V. figs. 2, 2 *a*.)

Sponges either cup- or funnel-shaped, or growing in thick undulating expansions; the margins rounded and frequently digitate. The walls are massive, and vary in thickness from 19 to 29 mm.

The upper surface has numerous, irregularly disposed papillæ, some of which project 7 mm. above the surface. The oscules at their summits are 2·25 mm. in width. These oscules are the apertures of cylindrical canals which are continued in an oblique direction to the base of the sponge. The under or lower surface of the wall has irregularly disposed apertures 1·5 mm. in width, and from one to three diameters apart, which project slightly above the surface. Both surfaces are provided with a compact dermal layer.

The substance of the wall is composed of delicate anastomosing fibres; the spicules of these fibres are obliterated.

A specimen in the collection measures 140 mm. in width and 110 mm. in height.

The distinguishing feature of this species is the presence of the oblique canals which extend throughout the sponge. These canals resemble those of the next genus *Stichophyma*; thus this form exhibits characters intermediate between *Verruculina* and *Stichophyma*. The only other species of *Verruculina* with which it can be compared is the *V. macrommata*, Rœmer; but in this form, so far as can be judged from the figures, the oscules are not carried on the summit of papillæ, and the intermediate surface is perforated with small apertures. Nothing is stated respecting the interior canal-structure of this species; so that I cannot say if any resemblance exists in this respect.

This species appears to be rare.

Distribution. Upper Chalk: Flamborough.

Genus STICHOPHYMA, *Pomel*, 1866.

STICHOPHYMA TURBINATUM, *Rœmer*, sp.

1840. *Manon turbinatum,* F. A. Rœmer, Nordd. Kreide. p. 3, t. 1. f. 5.

1878. *Stichophyma turbinata,* Zitt. Stud. II Ab. p. 61, t. 4. f. 5.

Distribution. Upper Chalk: Goslar.

STICHOPHYMA TUMIDUM, *Hinde*, n. sp. (Plate V. figs. 3, 4.)

1848. *Rhizospongia polymorpha,* p. p., Charlesworth, Proc. York. Phil. Soc. p. 73.

Sponges simple, elongate, club-shaped, or subcylindrical, usually widest near the summit, and gradually diminishing towards the basal end. The stem exhibits alternate horizontal swellings and contractions; near the upper portion in some specimens it becomes nodose; the summit is either conical, rounded, or subtruncate.

There is a great variety in the size, from small specimens measuring 130 mm. in height by 37 mm. in greatest width to large individuals 390 mm. in length by 120 mm. in width.

The openings of the vertical canals usually project slightly above the summit of the sponge; they vary between 3 and 7 mm. in diameter in different specimens. There is an example of this species, now in the Jermyn-Street Museum, which has the vertical canals partially separated from each other so as to form a group of chimney-like elevations near the summit of the sponge. The lateral surfaces are covered with numerous circular apertures, with slightly projecting thickened margins. In weathered specimens the margins are usually smooth. These apertures are sometimes in close contact; sometimes they are disposed in sinuous lines, which apparently indicate the presence of canals immediately beneath the dermal layer.

The internal skeleton appears to be composed of anastomosing fibres; the spicular structure has been destroyed.

This species may be readily distinguished by its large size, mode of growth, and the dimensions of the vertical and lateral apertures. It appears to be a very common form at Flamborough; and there is a single specimen—now composed of iron peroxide—from the Chalk of the south of England.

Distribution. Upper Chalk: Flamborough, Yorkshire; Bromley, Kent.

Genus JEREICA, *Zittel*, 1878.

JEREICA PUNCTATA, *Münst.* sp.

1833. *Siphonia punctata,* Münst., Goldf. Petref. Ger. Th. 1, p. 221, t. 65. f. 13.
1878. *Spumispongia punctata,* p. p., Quenst. Petref. Bd. 5, p. 402, t. 134. f. 12.
1878. *Jereica punctata,* Zittel, Stud. II Ab. p. 63, t. 5. f. 1.

Distribution. Upper Chalk: Sudmerberg, Goslar.

JEREICA POLYSTOMA, *Rœmer*, sp.

1864. *Jerea polystoma,* F. A. Rœmer, Palæon. Bd. 13, p. 34, t. 12. f. 5.
1878. *Jereica polystoma,* Zitt. Stud. II Ab. p. 63, t. 4. f. 11, 12.

Microscopic spicules of this species from Zittel's collection.

Distribution. Upper Chalk: Ahlten, Hanover.

JEREICA CLAVA, *Lee*, sp.

1839. *Siphonia clava,* Lee, Magazine of Nat. Hist. vol. iii. p. 12, f. 2, 3, 4.
1840. *Siphonia ocellata,* F. A. Rœmer, Nordd. Kr. p. 5, t. 2. f. 2.

Sponge simple, straight, elongate, club-shaped, with a conical summit. Greatest width a short distance below the summit; from thence it gradually tapers to the

narrow cylindrical base; occasionally slight constrictions are present. The largest example in the collection is 140 mm. in length and 48 mm. in diameter.

At the summit is a group of closely arranged circular or polygonal openings of vertical canals, each 2·8 mm. wide. The lateral surface of the sponge appears to have been smooth, and thickly covered with minute pore-like apertures 0·3 mm. in width. Beneath the dermal layer very delicate anastomosing fibres can be seen, which are apparently composed of minute thorny spicules; but the forms of these spicules are not sufficiently clear to be figured.

The *S. ocellata,* F. A. Rœm., appears to be identical with this species. Rœmer states that only six canal-apertures are present on the summit of his sponge; but the number of these canals evidently depends upon the size of the individual specimen, and furnishes no ground for a specific character.

Distribution. Upper Chalk: Flamborough.

JEREICA CYLINDRICA, *Hinde*, n. sp. (Plate VI. figs. 1, 1 *a*.)

Sponge massive, compressed, cylindrical, with an expanded flattened base; the summit truncate, with a shallow basin-like depression. The only specimen is 72 mm. in height and 84 mm. in width.

The surface characters are not well preserved, as the dermal layer has disappeared, and only filled up sinuous canals running in a vertical direction can be distinguished. In a vertical section through the central portion of the sponge, however, there are exposed two sets of canals—one generally vertical, and the other extending from the lateral surface to the central portion of the sponge. Both series of canals are minute, and do not appear to exceed 0·3 mm. in width.

The spicules of this sponge are very irregular in form, with numerous thorny and tubercular branches. They appear to be loosely connected together by their twig-like extensions; and distinct spicular fibres are not apparent in the vertical section.

In its general form and size, as well as in the delicate character and disposition of the canals and spicules, this species may be readily distinguished from the others of this genus.

Distribution. No label is attached to this sponge; but it appears to have been derived from the Upper Green Sand of Wiltshire.

Genus CŒLOCORYPHA, *Zittel*, 1878.

CŒLOCORYPHA, sp.

Distribution. Cretaceous: St. Adresse.

Genus SCYTALIA, *Zitt.* 1878.

SCYTALIA RADICIFORMIS, *Phillips*, sp. (Plate VI. figs. 4, 4 *a*, *b*.)

1835. *Spongia radiciformis*, Phillips, Geol. of Yorks. p. 90, t. 1. f. 9.
1864. *Eudea annulata*, F. A. Rœmer, Palæont. Bd. 13, p. 26, t. 11. f. 2.
1878. *Scytalia radiciformis*, Zitt. Stud. II Ab. p. 64, t. 5. f. 4.

Sponge either simple or occasionally two individuals growing in close contact, partially coalesce together, elongate, cylindrical, with occasional swellings and constrictions. The summit is conical; and the body tapers gradually below into a cylindrical stem: the natural termination of this is not preserved. A small specimen measures 65 mm. in length by 22 mm. in width; and a large example is 215 mm. long by 38 mm. wide.

The characters of the dermal layer cannot be distinguished in the Flamborough examples. The cloacal tube is about 8 mm. in width, and extends about two thirds the length of the sponge; from the summit-aperture sinuous canals 0·8 mm. wide radiate for a short distance down the cone. In a horizontal section numerous canals about 0·6 mm. in width can be seen extending from the cloacal tube towards the exterior surface of the sponge. The surface beneath the dermal layer exhibits very delicate reticulate fibres which, in specimens from Germany, are seen to be composed of minute, irregularly branched, spinous spicules.

This species appears to be common.

Distribution. Upper Chalk: Flamborough; Ahlten, Hanover.

SCYTALIA FASTIGIATA, *Lee*, sp. (Plate VI. fig. 3.)

1839. *Spongia fastigiata*, Lee, Magazine Nat. Hist. vol. iii. p. 14, f. 8.

Sponge simple, turbinate, with a very prominent conical summit, usually marked off from the main portion of the body by a prominent collar-like ridge. The sponge is widest at the junction of the cone with the body, and diminishes somewhat rapidly to a slight cylindrical stem. The lateral surface exhibits shallow ridges and furrows. An average specimen is 130 mm. in height by 70 mm. in width.

A smooth dermal layer appears to have covered the entire surface of the sponge. The cloacal tube is 10 mm. wide, apparently cylindrical, and extends nearly to the lower portion of the body. Numerous slightly arched canals 1 mm. in width extend from the cloaca towards the exterior. Similar canals are also exposed on the conical summit, radiating from the cloacal aperture, in specimens where the dermal layer has been removed. These superficial canals by the further growth of the sponge become inclosed, and then appear as interior canals.

The reticulate fibre of the interior can be distinguished in specimens treated with acid: but nothing beyond the general Rhizomorine character of the spicules can be recognized.

There are several examples of this species in the collection, and they are very constant in their outer form and other characters.

Distribution. Upper Chalk: Flamborough.

Scytalia terebrata, *Phillips.*

1835. *Spongia terebrata,* Phill. Geol. Yorks. p. 90, t. 1. f. 10.
1878. *Scytalia terebrata,* Zitt. Stud. II Ab. p. 65.

Sponge massive, subcylindrical, with a flattened conical summit. The lower portion of the body contracts to a cylindrical stem. The lateral surface carries numerous concentric, slight, subangular ridges and shallow open furrows. The only specimen in the collection is 220 mm. in length by 87 mm. in greatest width.

The surface, with the exception of the summit, is covered with a smooth dermal layer. The straight cylindrical cloaca is 13 mm. in width; from its aperture numerous sinuous canals extend to the margin of the cone. In a vertical section thickly set canals, 1·25 mm. in width, are exposed, extending from the cloaca to the exterior.

This species may be distinguished from the preceding by its different form and larger dimensions. It appears to be the species indicated by Phillips's figure, which, however, must have been drawn to the scale of one third the original.

Distribution. Upper Chalk: Flamborough.

Genus STACHYSPONGIA, *Zittel*, 1878.

Stachyspongia spica, *Rœmer*, sp. (Plate VI. figs. 2, 2 *a*.)

1864. *Siphonocœlia spica,* F. A. Rœmer, Palæont. Bd. 13, p. 30, t. 11. f. 5.
1878. *Stachyspongia spica,* Zitt. Stud. II Ab. p. 65, t. 5. f. 5.

Sponge massive, cylindrical, the surface covered with conical projections, disposed either irregularly or rudely spiral, with their summits directed upwards. The summit appears to have been truncate. An imperfect specimen is 210 mm. in length and 73 mm. in diameter. The opening of the tubular cloaca is 31 mm. wide at the summit, whilst at the basal end of the specimen it only measures 15 mm. Thickly set minute sinuous canals extend from its inner surface towards the exterior of the sponge. The outer surface appears to have been covered by a dermal layer, in which are irregularly disposed minute apertures from ·3 to ·6 mm. in width. Beneath this layer the surface is closely seamed by sinuous canals about 0·75 mm. in width. I have not detected any special apertures at the summit of the conical elevations. The spicules of the interior are so poorly preserved that only their Rhizomorine characters can be distinguished.

The example figured appears to belong to Rœmer's species, so far as can be judged from his short description and diminutive figure. He states, however, that the cloacal tube is only one fourth of the diameter of the sponge, but in the figure it

is represented as one third as large. In the Museum specimen the opening at the summit is nearly one half the diameter, whilst at the basal end it measures only one fourth the thickness of the sponge; so that at the base, at least, it agrees with Rœmer's description.

This sponge appears to be a rare form in the Grey Chalk; there is a fragment of a specimen in the collection inclosed in an Upper Chalk Flint, which also appears to belong to this species.

Distribution. Gray Chalk: near Dover. Upper Chalk: South Coast of England, probably.

Genus PACHINION, *Zittel*, 1878.

PACHINION SCRIPTUM, *Rœmer*, sp. (Plate VII. figs. 1, 1 *a*, *b*, *c*, *d*.)

1864. *Jerea scripta*, F. A. Rœmer, Palæont. Bd. 13, p. 34, t. 13. f. 1.
1878. *Pachinion scriptum*, Zitt. Stud. II Ab. p. 66, t. 5. f. 2.

Sponges simple, cylindrical, or inversely conical, the lower portion of the body gradually tapering to a cylindrical stem; the summit rounded or depressed conical. Very variable in size—a small specimen measuring 100 mm. in length by 55 mm. in width, whilst a large cylindrical example attains a length of 380 mm. and a width of 68 mm.

The cloacal tube is approximately cylindrical, and extends nearly the entire length of the sponge; at the summit of a fairly large specimen it is 18 mm. in width. The outer surface is covered by a smooth dermal layer. No distinctive canals are present, the circulation apparently being carried on between the apertures of the spicular fibre.

The interior of the sponge is formed by a relatively coarse fibrous network; the fibres are about 0·315 mm. in width. On the surface of weathered specimens and in sections the edges of the fibre have a rude resemblance to hieroglyphic characters.

The fibre is composed of irregular branching spicules with tubercled surfaces. The dermal layer is formed of much smaller and more branched spicules than those of the fibre. In the specimens from Flamborough only the general characters of the spicules of the fibre can be recognized; but in examples from Germany the spicules are beautifully preserved.

This species is very abundant in the Chalk at Flamborough; the fibre is, for the most part, in a silicified condition, though occasionally the silica is replaced by calcite. A few specimens are also met with in the Chalk of the south of England; but the siliceous spicular structure of these has been replaced by iron oxide, and is quite as indistinct as in the Flamborough examples. This species can be readily distinguished from the cylindrical specimens of *Scytalia* and *Phymatella* in the Flamborough beds by its smooth surface, the coarse characters of the fibre, and the absence of canals.

Distribution. Upper Chalk: Flamborough; south of England; Schweichelt, Brunswick (*Zittel's coll.*).

Family *MEGAMORINA*, Zittel.

Genus PLACONELLA, *Hinde*, n. g.

Sponges sessile, growing in flattened, cake-shaped masses. The upper surface uneven with shallow depressions, containing the apertures of several prominent canals. The surface between the depressions faintly furrowed, and with openings of numerous canals of different sizes. The interior permeated irregularly by canals.

The skeleton consists of smooth, robust, irregularly branching spicules, which closely intertwine together and form a reticulate mesh.

The spicules and the general structure of the skeleton of this genus are similar to to those of *Megalithista*, from which it is distinguished by its mode of growth and the absence of a central cloaca.

Placonella perforata, *Hinde*, n. sp. (Plate VII. figs. 2, 2 *a*, *b*.)

The only example of the genus has a circular outline about 68 mm. in diameter, and is 35 mm. in thickness. The upper surface is gently convex, the central portion is elevated; between this and the margins are three well-marked depressions, and one or two minor ones; in these depressions are several irregularly disposed canal-apertures about 2 mm. each in width. The general surface is also covered with slight furrows and irregularly disposed canal-apertures, in addition to the openings between the spicular mesh.

The spicular skeleton is best shown on the surface of the specimen. A detached spicule which I have been able to measure is 1 mm. in length by ·15 mm. in width. No distinctive dermal layer has been preserved; there are, however, in the depressions, fragments of long, straight, cylindrical spicules which may perhaps belong to the sponge.

The specimen in the collection was labelled *Achilleum tuberosum*, Goldf.; but this species has a skeleton of Rhizomorine spicules, and belongs to the genus *Cnemidiastrum*.

Distribution. Upper Jura: Nattheim, Würtemberg.

Genus DORYDERMA, *Zittel*, 1878.

Doryderma dichotomum, *Benett*, sp. (Plate VIII. figs. 1, 1 *a*, 1 *b*.)

1831. *Polypothecia dichotoma,* Benett, Catalogue of the Organic Remains of the County of Wilts, pl. 13.

1864. Non *Polyjerea dichotoma,* F. A. Rœmer, Palæont. Bd. 13, p. 36, t. 14. f. 1 *c*.

Sponge dendriform, growing from a simple upright cylindrical stem, which

divides and subdivides dichotomously; the branches are cylindrical or slightly compressed, approximately of the same thickness throughout, and from 14 mm. to 19 mm. in diameter in different specimens. The summits of the branches are rounded. An average specimen is 250 mm. in height, with an expansion of 190 mm. across the summit.

The branches are traversed longitudinally by a series of simple cylindrical tubes, 2 mm. each in width. No regular canal-openings appear to be present on the lateral surfaces of the branches; and the circulation seems to have been carried on between the irregular interspaces of the mesh, which average ·5 mm. in width.

The arms of the spicules are ·09 mm. in thickness; they are very compactly interwoven together so as to form a very close mesh. No dermal spicules have been detected in this species.

This species may be distinguished from *D. ramosum* and *D. Rœmeri* by the great regularity in its mode of growth and the close character of the spicular mesh. It appears to be abundant.

Distribution. Upper Green Sand: Warminster, Wiltshire.

DORYDERMA RAMOSUM, *Mantell*, sp. (Plate VIII. figs. 2, 2 *a.*)

1822. *Spongia ramosa,* Mantell, Fossils of the South Downs, p. 162, t. 15. f. 11.
1808. *A ramose Alcyonite,* Parkinson, Organic Remains, vol. ii. t. 7. f. 6.
1878. *Doryderma ramosa,* Zitt. Stud. II Ab. p. 68.

Sponge branching, growing from an upright cylindrical stem, which divides and subdivides occasionally, giving off short stumpy branches, from 12 to 18 mm. in diameter. The extremities of the branches are rounded. The vertical canals are about 1·5 mm. in width; they can hardly be distinguished, owing to the imperfect preservation of the interior structure of the sponge. The interspaces of the mesh on the surface are ·6 mm. wide. The spicular arms are ·1575 mm. in thickness. No surface-spicules have been preserved.

The type of Mantell's species is in the Museum collection. Its structure has been so completely altered by fossilization, that it was only after repeated scrutiny that I discovered a single spicule and was thus enabled to determine its true characters. The branching sponges which, from their similarity of form, I refer to this species are not uncommon in the interior of flints in the Chalk of Wiltshire. The surface-structure is usually well preserved; but the interior characters are mostly destroyed. This species is less regular in its mode of growth, and the spicules and mesh-interspaces are larger than in *D. dichotomum,* Benett, whilst the stems are usually smaller, and the mesh-interspaces also, than those of *D. Rœmeri,* Hinde.

Distribution. Upper Chalk: near Brighton; Oare, Wiltshire.

DORYDERMA RŒMERI, *Hinde*. (Plate VIII. figs. 3, 3 *a*, 3 *b*.)

1808. *A ramose Alcyonite,* Parkinson, Org. Rem. vol. ii. p. 92, t. 7. f. 7, 12.
1864. *Polyjerea dichotoma,* F. A. Rœm. Palæont. Bd. 13, p. 36, t. 14. f. 1.
1878. *Polyjerea dichotoma,* Quenst. Petref. Bd. 5, p. 423, t. 135. f. 10, 11.
1878. *Doryderma dichotoma,* Zitt. Studien, II Ab. p. 67, t. 7. f. 1.

Sponge branching, consisting of a thick stem from which short branches are given off in an irregular manner. The stem and branches traversed by numerous vertical canals about 2 mm. each in diameter. The interspaces of the mesh at the surface are from 1 mm. to 1·25 mm. in width. The spicules are ·1575 mm. in thickness, and occasionally 2 mm. in length. A dermal layer is formed by numerous trifid spicules, whose shafts fill the interspaces of the mesh, whilst their trifid summits slightly project outwards.

F. A. Rœmer's specific name, *dichotoma*, having been previously employed by Miss Benett for a sponge of this genus, it is necessary to give another designation to his species; and I have therefore termed it *Rœmeri*, in memory of its discoverer. From an examination of undoubted examples of this species, from the Upper Chalk of Brunswick, presented to the Museum by Prof. Zittel, I am enabled to determine its distinctness from either of the two foregoing species. It is much less regular in its habit of growth, the stem is much thicker, and the mesh interspaces are notably larger than in *D. ramosum* and *D. dichotomum*, Benett. The specimens appear to be rare in the Chalk of this country, and are only met with in the interior of flints. It is very seldom that the dermal trifid spicules are preserved; but I have detected them in one or two fragments in the Collection.

Distribution. Upper Chalk: Wiltshire; Brunswick (*Zitt. coll.*).

DORYDERMA BENETTI, *Hinde*, n. sp. (Plate IX. figs. 1, 1 *a*, 1 *b*.)

1808. *An Alcyonite,* Parkinson, Org. Rem. vol. ii. t. 10. f. 6.
1831. *Polypothecia,* Benett, Cat. Org. Rem. Wilts. t. 10. f. 1.
1847. Non *Jerea elongata,* Mich. Icon. Zoophy. p. 134, t. 29. f. 4.
1854. *Jerea Carteri,* p. p., Morris, Cat. Brit. Foss. p. 28.

Sponges simple, massive, elongate pear-shaped, or with a cylindrical body supported on a relatively thin stem, occasionally also subglobate. The summit is either rounded, horizontally truncate, or obtusely conical. In some examples the body gradually tapers downwards to the stem, in others there is a distinct constriction between the basal portion of the body and the top of the stem. There is great variability in the size of different examples—the smaller forms measure 72 mm. by 42 mm., whilst the larger specimens reach a length of 390 mm. and a width of 125 mm.

The body of the sponge is penetrated by numerous straight vertical canals, 2·5 mm. each in width, which open at the summit in close proximity to each other. A few

of these canals also extend into the stem. Numerous, closely set, arched canals, ·5 mm. wide, extend from the lateral surface towards the central portion of the sponge. The surface-openings of these lateral canals are formed by the irregularly shaped interspaces of the mesh. There are also numerous horizontal canals in the stem of the sponge.

The spicules of the body are robust, smooth, and irregularly branching, and about ·135 mm. in thickness. Some of the spicular arms gradually taper towards their extremities; in others, however, the extremities are expanded in a similar manner to those of the genus *Lyidium*. The spicules of the stem are slender, elongate, thread-like, with branching ends; they are loosely intertwined together in the direction of their length. No surface-spicules have been noticed.

This species is apparently abundant and generally well preserved. It is very probable that the figure given by Parkinson (*loc. cit.*) is of a sponge belonging to this species, though he makes mention of a large central cavity in the interior, of which there is no evidence in the figure. Michelin refers the form figured by Miss Benett to his *Jerea elongata*; but the spicular structure of the two is altogether different. Some examples resemble in appearance the figure of *Jerea pyriformis*, Lamx. Exp. Méthod. t. 78. f. 3; and they have apparently been referred to this species in Morris's Catalogue. There is, however, no resemblance in their spicular structure, as, according to Prof. Zittel, *Jerea pyriformis* belongs to the Tetracladina family. Prof. Morris also designates the sponges figured by Miss Benett in plate x. Cat. Org. Rem. by the name of *Jerea Carteri*, but no reference is given to the author of the specific name; and on this account, and on the further fact that in this plate two different species are figured, whilst it is not stated to which the *J. Carteri* applies, I have not retained that term for the present species.

Notwithstanding the variety of form and size in the examples which I refer to this species, there exists such a close resemblance in their canal and spicular structures that I do not see any ground for placing them under more than one species.

Distribution. Upper Green Sand: Warminster; Canamore quarry, near Crockerton.

Genus HOLODICTYON, *Hinde*, n. g.

Sponges inverted, conical, or irregular in form, with rounded or flattened summits, and stems with branching processes. In the centre of the summit there is a shallow cup-shaped or cylindrical cavity, which appears to extend only to a short distance into the sponge.

The skeleton consists of a meshwork of smooth, irregularly branching spicules; the spicular arms either attenuated or with a spoon-shaped or elongated expansion at their termination. No canals appear to be present.

I propose this genus to include a small group of sponges which closely resemble

those of *Doryderma* in the character and disposition of the spicular mesh, but, unlike that genus, appear to be destitute both of vertical and horizontal canals, so that the circulation is wholly carried on between the interspaces of the mesh.

HOLODICTYON CAPITATUM, *Hinde*, n. sp. (Plate VII. figs. 3, 3 *a*, 3 *b*.)

The examples of this species vary from 100 to 150 mm. in length, and from 30 to 85 mm. in width at the summit. The cloacal aperture, if it may be so termed, is from 6 to 9 mm. in width at the summit; in one example, which has been cut in two, its depth is 20 mm. The spicules are robust, and measure about ·2 mm. in thickness. No dermal layer has been detected. The spicules of the stem appear to be similar to those of the body of the sponge. The interstitial apertures are irregular in form, and from ·5 to ·75 mm. wide.

Distribution. Upper Green Sand: Warminster, Wiltshire.

Genus PACHYPOTERION, *Hinde*, n. g.

Sponges simple, massive, with cup- or goblet-shaped bodies, frequently of great thickness, supported on elongated cylindrical or compressed stems. The body of the sponge is traversed by a double series of canals—one, rising from the basal portion, is either vertical or follows the contour of the cup and opens into it; the other, and smaller, series commences on the exterior of the cup, and extends downwards in an arched direction towards the centre of the sponge. The skeletal spicules of the body of the sponge are smooth, curved, branching bodies of very irregular form; the extremities of the arms are either blunted or slightly expanded. They form a compact network both by the intertwining of the arms and by the attachment of the expanded ends to the surfaces of adjoining spicules. The spicules of the stem are elongated, thread-like, bifurcated at their ends, and loosely connected together. No dermal spicules have been preserved.

From *Doryderma* this genus is distinguished mainly by its cup-shaped mode of growth. It differs from *Heterostinia*, Zittel, in the apparent absence of those minute spicular bodies in which, according to Zittel, the larger spicules of this latter genus are imbedded, and which form the principal mass of the skeleton. It is possible that these smaller spicular elements may have been originally present in the examples of *Pachypoterion*; but, considering the state of preservation of these sponges, I think that traces of them would have remained.

The examples of this genus at present known are limited to the Upper Green Sand. On account of their resemblance in external form and in the canal-apertures of the inner and outer surfaces to *Chenendopora*, these sponges have hitherto been placed under that genus, and only by an examination of the spicular structure can the differences be detected.

Pachypoterion robustum, *Hinde*, n. sp. (Plate IX. figs. 2, 2 *a*, 2 *b*.)

Sponges cup- or goblet-shaped, the walls very thick, so that in some examples the cup is nearly filled with the siliceous skeleton. The body either gradually tapers to the simple elongated, cylindrical stem, or there is a sharp constriction between the base of the cup and the top of the stem. The specimens vary considerably in size: small examples measure 110 mm. in length by 65 mm. in width, whilst larger forms are 270 mm. long by 130 mm. in width.

The canal-apertures in the interior of the cup are, in some examples, arranged in concentric circles; they are about 2 mm. in width, and either elliptical or circular in section. The apertures of the exterior surface vary between ·5 and ·9 mm. in width. They appear to be disposed in a regular vertical series. In a horizontal section of the base of the cup, the lateral canals appear as so many radiating lines extending from the outer surface to near the central portion. The arms of the spicules measure ·135 mm. in thickness.

This species appears to be abundant. The examples vary considerably in size, thickness of the wall of the cup, and in the character of the stem; but as there are numerous gradations between the extreme forms, I have included them under a single species, which may be distinguished from the next by the thickness of the walls and of the spicules and the dimensions of the canals.

Distribution. Upper Green Sand: Warminster, Pewsey, Sambourne, Folkestone.

Pachypoterion compactum, *Hinde*, n. sp. (Plate IX. figs. 3, 3 *a*.)

1816. *Alcyonite* (funnel-form), W. Smith, Strata identified by Organic Fossils, t. 5. f. 12.

Sponges cup-, vase-, or open funnel-shaped, with simple cylindrical stems. The margins rounded. The walls of the body are from 5 to 9 mm. in thickness. The width of the cup varies in different examples from 65 to 110 mm.

The canals opening into the interior of the cup are 1 mm. in width, inconspicuous, and irregularly distributed. Those extending from the outer surface to the interior are very numerous, about ·3 mm. in width, and nearly horizontal in direction.

The spicules are of the same character as those of *P. robustum*, but of less thickness; they measure ·09 mm. in width, and about ·225 mm. in length. They are very closely interwoven together, so as to form a compact network.

This species is distinguished from *P. robustum* by its thinner walls, smaller spicules, and more compact spicular tissue.

The specimen figured is the original of William Smith's *Alcyonite*, loc. cit. t. 5. f. 12; but the lower portion of the stem is not represented. The interior of this specimen is filled with the hard matrix. The spicular structure (fig. 3 *a*) is from the exterior surface of the same example.

Distribution. Upper Green Sand: Warminster; Saumur.

Genus HETEROSTINIA, *Zittel*, 1878.

HETEROSTINIA OBLIQUA, *Benett*, sp. (Plate X. figs. 2, 2 *a*, 2 *b*, 2 *c*.)

1831. *Polypothecia obliqua*, Benett, Cat. Org. Rem. Wilts. t. 8. f. 1.

Body of sponge consisting of a variously convoluted plate-like wall, either platter-, ear-, or fan-shaped, and not infrequently, by the coalescence of the wall-margins, becoming either cup- or open funnel-shaped. The body is usually supported by one or more rod-like short processes, which are sometimes compressed so as to form semipalmate expansions. The walls are from 7 to 10 mm. in thickness. The examples vary greatly in size: a large cup-like specimen attains a width of 85 mm., and one platter-shaped form is 200 mm. in extension.

On both surfaces of the wall there are numerous irregularly disposed circular apertures, about ·7 mm. each in width, and from one to three diameters apart; between these circular apertures are the irregular openings formed by the spicular mesh. No indications of canals in the interior of the wall have been preserved in the specimens which I have examined, though occasionally the sponge-wall is penetrated by cavities which appear to be due to external causes.

The spicules of the body-skeleton are relatively large, vermiculate, branched, and attached to each other by their slightly expanded extremities. In the best preserved specimens the surface of the body-spicules exhibits a very fine, minute granulation; in other specimens the spicules appear to have smooth surfaces, but the smoothness may be due to the wearing-off of the fine granulation by fossilization. In all other respects the sponges with the granulated surfaces to the spicules and those with smooth surfaces are precisely similar, so that I find it impossible to constitute two species based on this feature alone. The body-spicules vary in thickness between ·112 mm. and ·1575 mm. The spicules of the stem are thinner and more elongated than those of the body, and they are connected by being adpressed and intertwined together. The sponge appears to have possessed a dermal layer consisting of trifid spicules with horizontally expanded, bifurcated, and pointed head-rays. This dermal layer is but very rarely preserved. The minute irregularly shaped spicules which, in the type of the genus, intervene between the larger mesh-spicules are also very rare, and I have only detected their presence in portions of the stem.

In the mode of attachment of the body-spicules of this species by their slightly expanded extremities, these sponges resemble those of the genera *Lyidium* and *Pachypoterion*; and I was at first disposed to place them under the former of these two genera. There are slight evidences, however, of the presence of the minute spicular bodies which constitute the distinguishing character of the genus *Heterostinia*, Zitt.; and Prof. Zittel, who has examined one of these sponges, pronounces it a genuine example of this genus. In this case, the definition of *Heterostinia* will

have to be amended, so as to include sponges in which the body-spicules have expanded extremities, as well as those with attenuated and pointed ends to the body-spicules.

The figure given by Miss Benett, *loc. cit.* t. 8. f. 1, leaves no doubt as to the identity of the form represented, for there is no other sponge from the Wiltshire Chalk with the peculiar elongated compressed stem or root shown in her figure. There is no certainty, however, that the figure of *Chenendopora obliqua**, Michelin, represents the same species as *Polypothecia obliqua*, Benett.

This species appears to have been very common in the Upper Chalk. As a rule the specimens are inclosed in the hollows of flints, and exhibit, when thus preserved, the spicular structure of the surface in a very beautiful manner. Generally the stem of the sponge with only a small portion of the body is preserved, and in many instances the stem alone remains in the interior of the flint. A few examples have been preserved in the Chalk of Flamborough, and in these the body-wall remains and the stem is usually wanting. In one example from this locality the sponge is nearly flat and platter-shaped, and instead of a single central stem it gives off from different parts of its under surface numerous small rod-like processes.

Distribution. Upper Chalk: Flamborough; Beckhampton, near Brighton; Warminster, Stockton, Upware.

Genus NEMATINION, *Hinde*, n. g.

Sponges simple, elongate, rod-like in form, with a relatively small cup-shaped summit, supported on a long cylindrical simple or bifurcated stem, which is either branched or obtuse at its lower extremity. Below the cup vertical canals extend throughout the length of the stem. The exterior surface is thickly covered with the apertures of horizontal canals. The skeleton is composed of elongated, smooth, thread-like spicules, which bifurcate near their extremities. These spicules are interlocked together by their filiform extremities so as to form an open mesh-work.

The peculiar feature of this genus is the small inconspicuous cup carried on the summit of a very long stem. In its general form, and in the character of the spicules, the genus approaches *Carterella*, Zitt.; but this latter genus has a rounded summit, and the spicules, as a rule, are knobbed and blunted at their ends.

Nematinion calyculum, *Hinde*, n. sp. (Plate X. figs. 1, 1 *a*, 1 *b*, 1 *c*.)

The rod-like stem of the sponge is either straight or sinuous, usually simple, though bifurcate examples occur. There is great variation in the length of different specimens: the largest form which is in the collection is 310 mm. in length by

* Icon. Zooph. p. 132, t. 41. f. 2 *a*, *b*.

45 mm. in width at the summit; a smaller form is only 20 mm. in width and 160 mm. in length. In some examples the width of the cup at the summit but slightly exceeds the width of the stem.

The vertical canals penetrating the stem are ·7 mm. in width and irregularly disposed. In some examples the surface of the stem exhibits sinuous vertical canals. The apertures of the horizontal canals, about ·5 mm. in width, are present both on the exterior of the cup and the stem; they are very closely set, oval or circular in form, and bounded by the spicules of the mesh.

The spicules forming the cup and the *exterior* portion of the stem are ·0675 mm. in thickness; they are disposed in close contact in the direction of the length of the sponge. The spicules of the *interior* of the stem are much more slender than those near the outer surface, and they are loosely connected together by their bifurcated extremities. In length they vary between ·787 and 1·575 mm.

The specimens are not uncommon, though perfect examples are rare.

Distribution. Upper Green Sand: Warminster, Wiltshire.

Genus CARTERELLA, *Zittel*, 1878.

Carterella cylindrica, *Zitt.*

1878. ***Carterella cylindrica,*** Zitt. Studien, II Ab. p. 68, t. 2. f. 7 and t. 7. f. 2.

Distribution. Upper Green Sand: Kelheim, near Regensburg (*Zittel's coll.*).

Carterella spiculigera, *Rœmer*, sp.

1864. ***Jerea spiculigera,*** F. A. Rœmer, Palæont. Bd. 13, p. 34, t. 12. f. 6.
1878. ***Eulespongia,*** Quenst. Petref. Bd. 5, p. 414, t. 135. f. 1, 2.
1878. ***Carterella spiculigera,*** Zitt. Studien, II Ab. p. 69, t. 7. f. 2.

Detached spicules of this species from Zittel's collection.

Distribution. Upper Chalk: Ahlten, Hanover.

Genus ISORAPHINIA, *Zittel*, 1878.

Isoraphinia texta, *Rœmer*, sp. (Plate X. figs. 3, 3 *a*, 3 *b*.)

1864. ***Siphonocœlia texta,*** Rœmer, Palæont. Bd. 13, p. 29, t. 10. f. 11.
1878. ***Eulespongia texta,*** Quenst. Petref. Bd. 5, p. 417, t. 135. f. 3–7.
1878. ***Isoraphinia texta,*** Zitt. Studien, II Ab. p. 69, t. 5. f. 8 and t. 7. f. 3.

Body of sponge cylindrical, the lower portion gradually tapering to a simple rounded stem; the summit is truncate or depressed conical. Fairly large specimens measure 230 mm. in length by 54 mm. in width.

The cloacal tube is nearly cylindrical, and extends to the lower portion of the body

of the sponge; in a large specimen it is 13 mm. wide at the summit. Specialized canals do not appear to exist, and the circulation seems to have been carried on through the interstices of the spicular mesh.

The spicules are relatively large, straight, or slightly bent, cylindrical, with nodose extremities; they attain a length of 1·25 mm. In the interior of the sponge these spicules are [illegible] small bundles, and interwoven at their extremities to form an open meshwork. On the exterior surface, however, they are disposed without any definite arrangement, and cross each other in every direction, forming a compact surface-layer.

This species is not uncommon in the Flamborough Chalk; and may be distinguished from the cylindrical forms of *[illegible]* and other genera occurring in the same beds by the scattered layer of spicules on the exterior surface of the sponge, which have been preserved, owing to their relatively large size.

Distribution. Upper Chalk, Flamborough. Pläner-Kalk: Dohrnten, near Salzgitter (*Zittel's* coll.).

Family ANOMOCLADINA, Zittel.

Genus CYLINDROPHYMA, *Zittel*, 1878.

CYLINDROPHYMA MILLEPORATA, *Goldf.* sp.

1833. *Scyphia milleporata*, Goldf. Petref. I Th. p. 8, t. 3, f. 2.

1877. *Scyphia milleporata*, Quenst. Petref. Bd. 5, p. 130, t. 121, f. 1–7.

1878. *Cylindrophyma milleporata*, Zitt. Studien, II Ab. p. 70, t. 3, f. 6.

Distribution. Upper Jura: Oeringen; Wodna, Randen.

Genus MELONELLA, *Zittel*, 1878.

MELONELLA RADIATA, *Quenst.* sp.

1858. *Spongites radiatus*, Quenst. Der Jura, p. 679, t. 82, f. 13.

1833. *Scyphia pyriformis*, p. p., Goldf. Petref. I Th. t. 35, f. 10.

1877. *Spongites radiatus*, Quenst. Petref. Bd. 5, p. 240, t. 136, f. 60–72.

1878. *Melonella radiata*, Zitt. Studien, II Ab. p. 71, t. 3, f. 7.

Distribution. Upper Jura: Heuberg.

Genus LECANELLA, *Zittel*, 1878.

LECANELLA PATERAEFORMIS, *Zittel*.

1878. *Lecanella pateraeformis*, Zitt. Studien, II Ab. p. 71, t. 6, f. 1.

Detached spicules of this species.

Distribution. Upper Chalk: Ahlten, Hanover.

mesh is for the most part dissolved away, and only empty moulds remain; in a few instances, however, the spicules remain, and are now of a reddish material. The canals have been filled with cherty silica, and the minute projecting rods connecting adjoining canals have been produced by the silica filling in the minute spaces between the spicular mesh. This appearance Rœmer mistook for the infilling of connecting tubes in the wall of a coral. The condition of these sponges from Tennessee is precisely similar to that of specimens of *Astylospongia*; and no doubt can be entertained that, like this last-named genus, they were originally siliceous. The examples from New Brunswick, however, have had their original skeleton replaced by calcite; and this fact led Prof. Duncan to believe that they were originally calcareous, so that "there must have been a former mimetic and calcareous group of Spongida." The character of the spicules cannot be so clearly seen in the calcite specimens; and after a close examination of the forms from Tennessee and New Brunswick, I believe that the spicular elements resemble those of the Anomocladine family rather than of the Tetracladina.

The Tennessee examples appear to have been completely spherical, those from New Brunswick are oblate spheroidal in form; the internal structure and dimensions of the canals appear to be the same in the sponges from both localities.

Distribution. Silurian (Lower Helderberg Group): near Dalhousie, New Brunswick; Perry county, Tennessee (*Pearson's coll.*). I have also seen specimens of the same species from the Lower Helderberg group at Schoharie, New York.

Family *TETRACLADINA*, Zittel.

Genus AULOCOPIUM, *Oswald*, 1846.

Aulocopium cylindraceum, *Ferd. Rœmer*.

1861. *Aulocopium cylindraceum,* Rœmer, Fossile Fauna von Sadewitz, p. 9, t. 3. f. 2*a*, 2*b*.
1878. *Aulocopium cylindraceum,* Zittel, Studien, II Ab. p. 73.

Distribution. Silurian: Gotland.

Genus PHYMATELLA, *Zittel*, 1878.

Phymatella intumescens, *Rœmer*, sp.

1864. *Eudea intumescens,* F. A. Rœmer, Palæont. Bd. 13, p. 26, t. 11. f. 1.
1878. *Scyphia intumescens,* Quenst. Petref. Bd. 5, p. 392, t. 133. f. 23–26.
1878. *Phymatella intumescens,* Zitt. Studien, II Ab. p. 74.

There is but a single imperfect example of this species in the Museum collection, which is cylindrical in form, tapering near the base, with irregular hollows in its

lower portion. It is 43 mm. in width; the cloaca is cylindrical, about 12 mm. in width, and extends nearly to the base of the sponge. The exterior surface is thickly covered with numerous irregularly disposed canal-apertures 1 mm. wide; the canals extend in a nearly horizontal direction towards the centre of the sponge. The four-armed spicules are slender with inconspicuous nodules. The specimen is preserved in Chalk, and the spicular structure has been changed into reddish peroxide of iron.

Distribution. Upper Chalk: South of England.

PHYMATELLA HETEROPORA, *Rœmer*, sp.

1840. *Scyphia heteropora,* Rœm. Nordd. Kreide, p. 7, t. 2. f. 13.
1878. *Phymatella heteropora,* Zitt. Studien, II Ab. p. 74, t. 8. f. 2.

Detached spicules of the body and surface-layer of this species.

Distribution. Upper Chalk: Biewende, Brunswick (*Zittel's coll.*).

PHYMATELLA RETICULATA, *Hinde*, n. sp. (Plate XI. figs. 1, 1 *a*, 1 *b*.)

Sponges massive, either cylindrical, club-shaped, or obliquely turbinate, with a depressed conical or truncated summit. The lower portion of the body gradually tapers to a cylindrical stem, which terminates in a branching root. In some specimens nodose or spur-like projections are irregularly scattered over the surface. The surface exhibits a coarse irregular reticulation. There is considerable variation both in the size and form; cylindrical specimens reach a length of 320 mm. by 72 mm. in width; the turbinate examples, though not so long, reach to a greater width—one of these is 105 mm. in diameter.

The tubular cloaca in a large specimen is 24 mm. wide at the summit; from its margins branching canals radiate down the summit of the sponge. The canals extending from the outer surface to the interior are 1 mm. in width.

The internal skeletal structure of these sponges has been so greatly altered by fossilization, that it has been very difficult to determine the original character of the spicules. I have, however, been able to discover in a thin transverse section traces of the straight arms and junction-nodes of tetracladine spicules; the spicular arms are ·225 mm. in length by ·033 mm. in width. The outer surface, when treated with dilute acid, also shows indistinct traces of similar spicules.

These sponges have been referred to *Phymatella intumescens*, Rœm., sp., from which, however, they are distinguished by their massive walls, the coarse irregular reticulation of the surface, and their generally large proportions.

Distribution. Upper Chalk: Flamborough, Yorkshire; South of England.

PHYMATELLA NODOSA, *Hinde*, n. sp. (Plate XI. figs. 2, 2 *a*.)

Sponge nearly cylindrical or tapering in form, the basal end rounded and destitute of any peduncle or point of attachment; the summit of the specimen has not been preserved. The surface in the upper portion is covered with obtusely rounded nodes; the lower portion is nearly smooth. The single imperfect example is 165 mm. in length, 60 mm. wide at the summit, and 40 mm. at the base. The wall is 20 mm. in thickness at the summit.

The cloacal tube extends for a distance of three fourths the length; it is 21 mm. wide at the top, and 10 mm. at the lower end. The canals opening into the cloaca are 1·2 mm. wide, and they have a downward curve. The exterior surface of the sponge exhibits apertures of various sizes, which appear to be the openings of canals which extend in a curved direction towards the interior of the wall.

The spicular structure of the interior has been obliterated, but on the outer surface in some places small tetracladine spicules can be seen; the arms are smooth, about ·2 mm. in length; the nodes at the junction of the arms are inconspicuous.

In outer form this species somewhat resembles *Phymatella heteromorpha* *, Rœmer, sp., but the walls are much thicker and the canal-apertures smaller than in that species. In the curved direction of the canals this species differs from the typical forms of the genus, but in other respects its characters are similar.

Distribution. Upper Green Sand: Warminster.

PHYMATELLA, sp.

Distribution. Upper Chalk: South of England; France?

Genus AULAXINIA, *Zittel*, 1878.

AULAXINIA SULCIFERA, *Rœmer*, sp.

Siphonocœlia sulcifera, F. A. Rœmer, Palæont. Bd. 13, p. 30, t. 11. f. 7.
Aulaxinia sulcifera, Zitt. Studien, II Ab. p. 75, t. 8. f. 4.

Distribution. Upper Chalk?

AULAXINIA COSTATA, *Hinde*, n. sp. (Plate XII. figs. 1, 1 *a*.)

Sponge elongated, inversely conical, with rounded summit (no stem preserved); length 80 mm. by 35 mm. in width. The cloacal aperture is 9 mm. in width; from its margin a series of eighteen nearly straight simple canals, 2·3 mm. in width, and equidistant from each other, extends to the base. Between these vertical canals are the apertures (about 1 mm. in width) of the horizontal canals. The spicules are relatively large, the arms apparently smooth and about ·5 mm. in length.

* Palæontographica, Bd. 13, p. 22, t. 8. f. 11.

The only example of this species is a somewhat worn specimen from flint-gravel. The canals in this specimen have been infilled with silica, and now project as so many ridges down the sides of the sponge. The spicules have also disappeared, but their moulds in silica are distinctly shown.

This species may be distinguished from *A. sulcifera* by the greater number of the vertical canals, also by their straight direction, and the larger size of the skeletal spicules.

Distribution. Gravel, Upper Chalk: Stanway, Gloucestershire.

Genus CALLOPEGMA, *Zittel*, 1878.

CALLOPEGMA SCHLÖNBACHI, *Zitt.*

1878. *Callopegma Schlönbachi*, Zitt. Studien, II Ab. p. 75, t. 9. f. 1.

Detached skeletal spicules of this species.

Distribution. Upper Chalk: Ahlten, Hanover (*Zittel's coll.*).

CALLOPEGMA OBCONICUM, *Hinde*, n. sp. (Plate XI. figs. 3, 3 *a*, 3 *b*.)

Sponges small, inversely conical, apparently sessile. The upper surface is flat, or even in some examples slightly convex; the basal termination is obtusely rounded. An average specimen is 20 mm. in height and 22 mm. in diameter.

In the central portion of the summit are the apertures of several canals, about 2 mm. each in width, which extend downwards into the sponge; there is also a system of branching sinuous canals, seen in weathered specimens, which radiate from the centre of the upper surface towards the sides of the sponge. The lateral surface appears also to be furnished with minute pores.

The spicular structure, as seen in a vertical section, is of an open, irregular character. The arms or rays of the spicules are about ·5 mm. in length. No dermal layer has been preserved in the specimens.

This species is usually preserved in the interior of flints, and the spicular structure is seldom retained. In some instances, however, the spicules remain in the form of iron peroxide. This form may be distinguished from *Callopegma acaule*, Zittel *, by its smaller size, the absence of a cup in the centre, and its even surface.

Distribution. Upper Chalk: South of England.

CALLOPEGMA FICOIDEUM, *Hinde*, n. sp. (Plate XI. figs. 4, 4 *a*, 4 *b*.)

Sponges fig-shaped or subspherical, with flattened or slightly rounded summits, and with one or more straight or curved peduncular projections at the base, and occasionally slight nodosities on the surface. An average specimen is 60 mm. in height and 50 mm. in diameter.

* Studien, II Ab. p. 75, t. 2. f. 6 *a*.

Several vertical canals, 1·8 mm. wide, open at the summit; the lateral surfaces have scattered apertures of canals, ·8 mm. in width.

The body-spicules have prominent junction-nodes and relatively long smooth arms. The dermal layer is composed of the horizontally-expanded heads of large trifid spicules, some of which are 1 mm. in extension. There are traces of minute spicular bodies between the arms of the larger spicules of the dermal layer, but their form has been lost.

The specimens only occur in the interior of flints; they retain the outer form and the spicules of the dermal layer, as well as of the body-skeleton immediately beneath; but the interior is a mass of porous silica in which even the canals are destroyed.

This species differs from *C. acaule*, Zittel, principally in its rounded summit and the absence of a cup.

Distribution. Upper Chalk: Croydon, Guildford, Surrey.

Genus TRACHYSYCON, *Zittel*, 1878.

TRACHYSYCON NODOSUM, *Hinde*, n. sp. (Plate XII. figs. 3, 3 *a*, 3 *b*.)

Body of sponge massive, barrel-shaped, with a truncated summit bounded by a subangular margin; the stem has not been preserved. The lateral surfaces are covered with rounded or obtuse elevations disposed irregularly. The only specimen is 155 mm. in height and 117 mm. in width.

The cloaca is subcylindrical, somewhat wider below than at its aperture; it extends rather more than one third the length of the body; in the present specimen it is 55 mm. in length by 31 in width. The interior surface of the cloaca is thickly covered with the canal-apertures, which are apparently disposed in vertical series. These apertures are 1·75 mm. in width. The canals from the basal portion of the sponge-body run nearly straight to the cloaca; those from the lateral portion follow a winding course; whilst the canals springing from near the upper margin of the sponge are bent downwards, following the contour of the summit so as to open into the upper portion of the cloaca. There is also a series of numerous fine canals, ·75 mm. in width, extending from the exterior surface in a curved direction towards the centre of the sponge.

The body-spicules are moderately large; their arms, ·3 mm. in length, are smooth or sometimes tuberculated; they are much branched, and the junction-nodules are swollen. No surface-spicules have been preserved.

The single example of this species in the collection is filled with translucent chert, in which the body-spicules are fairly well preserved; the exterior surface is rough, and shows no structure.

Distribution. Upper Green Sand: Warminster.

TRACHYSYCON SULCATUM, *Hinde*, n. sp. (Plate XII. figs. 2, 2 *a*, 2 *b*.)

Sponge massive, fig-shaped, widest near the summit, which is depressed or slightly rounded; the stem has not been preserved. The exterior surface, with the exception of the summit, which appears to have been smooth, is furnished with sinuous, interrupted, vertically disposed ridges and furrows, and also with conical, slightly curved, obtusely pointed, spinous processes, about 15 mm. in length, which have no definite arrangement. An average specimen is 110 mm. in height and the same in thickness.

A wide funnel-shaped cloaca extends nearly to the base of the sponge; numerous slightly arched canals, 1·5 mm. in width, open into this cloaca; there are also sinuous branched canals exposed on the summit, radiating from the cloacal margin. The spicular skeleton of the interior is completely obliterated. The surface appears to have been covered with a dermal layer of minute irregular spicules with horizontal sinuously branching head-rays.

There are two examples of this form in the collection, both of which are completely infilled with silex as well as partially enveloped in it. The species is distinguished from the *Trachysycon* (*Plocoscyphia*) *muricatum*, Rœmer *, by its depressed summit, wide cloaca, and its ridged surface.

Distribution. Upper Chalk: South of England.

Genus SIPHONIA (*Parkinson*), pars, *Goldfuss.*

The authorship of this genus is involved in obscurity. The name first appears in the 'Petrefacta Germaniæ,' p. 16, and is attributed by Goldfuss to Parkinson; but I have been unable to find the term employed anywhere by this last author, though he refers at considerable length in the second volume of his 'Organic Remains' to sponges of this genus under the general term of Fossil Alcyonia. Most later authors appear to have followed Goldfuss in ascribing the genus to Parkinson without indicating where the generic characters were defined. Under these circumstances Goldfuss must be considered the author of the genus, and the first species which he describes, *Siphonia piriformis*, will have to be regarded as its type. Goldfuss has included in *Siphonia* the sponges which Lamouroux placed under the genera *Hallirhoa* and *Jerea*; and many later authors, including Prof. Sollas, who has given a very elaborate description of the structure and affinities of *Siphonia*, adopt the Goldfussian extension of the genus. I purpose, however, to follow the proposal of Prof. Zittel to retain the genus *Siphonia* for such typical forms as *Siphonia piriformis*, *tulipa*, *ficus*, &c., and to place the lobate forms under the genus *Hallirhoa*, Lamx., and the forms without a cloacal tube under *Jerea*, Lamx. It is worthy of notice that if *Hallirhoa* or *Jerea* are to be considered as synonymous with *Siphonia*,

* Palæontographica, Bd. 13, p. 28, t. 10. f. 9.

then, by the rules of priority, the term *Siphonia* will have to give place to one or the other of the genera of Lamouroux which were published anterior to Goldfuss's *Siphonia*.

The genus *Choanites*, Mantell, 'Fossils of the South Downs,' 1822, p. 178, is of a later date than the *Hallirhoa* of Lamouroux, besides which the term is inapplicable to sponges like *Siphonia*, for the first two species placed under the genus by Mantell, *Choanites subrotundus* and *flexuosus*, are not Lithistid sponges at all, and the type of *Choanites* is in reality a Hexactinellid sponge.

Siphonia piriformis, *Goldfuss*.

1853. *Siphonia piriformis*, Goldfuss, Petref. Th. 1, p. 16, t. 6. f. 7 *a*.
1878. *Siphonia piriformis*, Zittel, Studien, II Ab. p. 79, t. 9. f. 7.
Non *Siphonia pyriformis*, Sowerby, Geol. Trans. 2nd ser. vol. iv. t. 15 *a*.
Non *Siphonia pyriformis*, Sollas, Quart. Journ. Geol. Soc. vol. xxxiii. t. 25. f. 1, 3, 4, 6, 8.

Distribution. Craie: Vaches Noires, Ranville, St. Adresse.

Siphonia tulipa, *Zittel*. (Plate XIII. figs. 2, 2 *a*, 2 *b*, 2 *c*.)

1878. *Siphonia tulipa*, Zittel, Studien, II Ab. p. 79, t. 9. f. 5.
1836. *Siphonia pyriformis*, Sowerby, Geol. Trans. 2nd ser. vol. iv. p. 340, t. 15 *a*.
1854. *Siphonia pyriformis*, Mantell, Medals of Creation, p. 231, f. 1–3.
1877. *Siphonia pyriformis*, Sollas, Quart. Journ. Geol. Soc. vol. xxxiii. t. 25. f. 1, 3, 4, 6, 8.
1878. *Siphonia Websteri*, Quenst. Petref. Bd. 5, t. 135. f. 15–19.

Sponges simple or occasionally bifid, with conical or subcylindrical bodies, either sharply constricted beneath the body or gradually tapering to a cylindrical stem which usually branches at its termination. There is great variation in the size of different specimens: a small form in the collection has the body only 21 mm. in length by 13 mm. in width; a large specimen measures 105 mm. in length by 46 mm. in width.

The cloaca is a narrow elongated tapering tube; the aperture is narrow, with a sharp margin, and about 8 mm. in width. It extends to the central or even the lower portion of the body of the specimen. The arched canals which open into the cloaca are about 1·25 mm. in width, whilst those extending from the outer surface to the interior are very numerous, closely set, and average ·5 mm. in width. Branching canals radiating from the cloacal margins over the upper surface can also be distinguished in some examples.

The spicules forming the interior meshwork of the body are mostly smooth-armed, though near the extremities the arms, together with the minute branches, are frequently tuberculated. The spicular arms are ·135 mm. in length, measuring from the centre to the point where they commence to divide, and ·052 mm. in thickness.

The spicules of the stem are elongated and thread-like. No dermal layer has been preserved.

This species is extremely abundant in the Upper Green Sand of Blackdown and Warminster. The Blackdown examples usually have a sharp constriction between the basal portion of the body of the sponge and the stem, which also is of a slender character. The Warminster examples, on the other hand, have more elongated bodies, which not infrequently gradually taper below to form a stem of considerable robustness. There are, however, both at Blackdown and Warminster, specimens exhibiting characters intermediate between the two extremes, so that it is quite impracticable to limit this species merely to forms which possess the marked constriction between the body and the stem. In all other features the specimens from these two localities appear to be similar.

Distribution. Upper Green Sand: Blackdown, Warminster.

Siphonia incrassata, *Goldfuss.*

1833. *Siphonia incrassata,* Goldfuss, Petref. Th. 1, p. 17, t. 30. f. 5.
1878. *Siphonia incrassata,* Zittel, Studien, II Ab. p. 79.

Distribution. Pläner-Kalk: Bohemia. Craie Chloritée: Vaches Noires; Sudmerberg.

Siphonia ficus, *Goldfuss.* (Plate XIII. figs. 3, 3 *a.*)

1833. *Siphonia ficus,* Goldfuss, Petref. Th. 1, p. 221, t. 65. f. 14.
1878. *Siphonia ficus,* Zittel, Studien, II Ab. p. 79, t. 9. f. 6.

Sponges fig-shaped or subspherical, with gently rounded summits, either apparently sessile or with short branching stems. An average specimen is 75 mm. in height and the same in width. The cloaca is cup- or funnel-shaped; it extends to nearly the centre of the sponge; the margins are sharp. In an average specimen it is 23 mm. in width at the summit. The interior surface exhibits the closely disposed apertures (2·25 mm. each in width) of the canals which open into it. Branching canals also radiate from the cloacal aperture over the surface. The spicular mesh is entirely replaced by calcite, and the forms of the individual spicules are nearly entirely obliterated. The outer surface of the specimens is now smooth and only exhibits a delicate fibrous network.

Distribution. Grey Chalk: near Dover.

Siphonia Königi, *Mantell,* sp. (Plate XIII. figs. 4, 4 *a.*)

1822. *Choanites Königii,* Mantell, Geol. of Sussex, p. 179, t. 16. f. 19, 20.
1808. *A Flint, from a gravel-pit,* Parkinson, Organic Remains, vol. ii. p. 100, t. 9. f. 1.
1850. *Choanites Königi,* Dixon, Foss. Sussex, t. 17. f. 1, 3, 4.
1854. *Choanites Königi,* Mantell, Medals of Creation, p. 234, f. 1, 3, 4.

1877. *Siphonia Königii,* Sollas, Quart. Journ. Geol. Soc. vol. xxxiii. p. 817.
1878. *Siphonia Koenigi,* Zitt. Stud. II Ab. p. 79.

Sponges pear-shaped or subspherical, the summits usually truncate; stem cylindrical, apparently slender. An average specimen is 100 mm. in height by 70 mm. in width.

The cloacal tube is cylindrical or funnel-shaped, and extends nearly to the basal portion of the body. Its aperture is very wide, and the margins are rounded. Very strongly marked branching canals, 2 mm. in width, radiate from the margin of the cloaca down the sides of the sponge. The lateral surfaces exhibit circular or subangular apertures of canals from 1 to 2 mm. in width. Some of these apertures are bridged over by minute thread-like extensions of spicular fibre crossing them.

The spicules forming the mesh are relatively large, but they are so incrusted with silica that it is impracticable to measure them. A dermal layer appears to have extended over the outer surface of the sponge and over the interior of the cloacal tube as well. The spicules composing it have horizontally expanded, slightly bifurcate head-rays; the shafts, if present, extended into the sponge.

Most of the examples of this species are preserved in the interior of flints, and retain merely the form of the cloaca and the larger canals, the spicular structure having entirely disappeared. There are, however, in the Museum collection a few specimens from Flamborough which, in common with the other sponges from that locality, are preserved in a chalky matrix, which can be removed by treatment with dilute acid; and these exhibit the form and canal-structure in a very perfect manner, but the spicules for the most part are masked by siliceous accretions. They further show the important feature of a dermal layer, which has hitherto not been discovered in any example of the genus. This layer covered over the exterior branching summit canals, and seems also to have covered the interior surface of the cloaca, for in a well-preserved specimen the cloaca exhibits a smooth surface like that of the exterior, and here and there the openings of the canals can be detected beneath this layer.

In some of the examples of this species, preserved in flint, there is a filled-up spiral tube or canal, from 4 to 8 mm. in width, which winds through the interior of the body between the cloaca and the outer surface, and opens out at the summit of the sponge in the vicinity of the cloacal aperture. This tube has been described by Cunnington * as forming part of the original fabric of the sponge, and probably connected with the reproductive system. The more probable suggestion is that the tube has been formed by an annelid, which has built its shell *pari passu* with the growth of the sponge; and it is not improbable that its constant proximity to the cloacal aperture has arisen from the support which the animal inhabiting the tube may have derived from the stream of water passing out of the cloaca. Examples in the Museum show clearly that this spiral tube was not peculiar to this species of

* Report of British Association, Swansea, 1848, p. 67.

branching extremities are thickly covered with minute tubercles. The spicular arms are ·202 mm. in length by ·067 mm. in thickness.

The extreme variability in the form of this species is well exemplified in the numerous specimens in the Museum.

Distribution. Upper Green Sand: Warminster, Wiltshire. Red Chalk: Hunstanton, Norfolk (*Prof. Seeley*). Craie Chloritée: Vaches Noires, Havre.

HALLIRHOA COSTATA, var. BREVICOSTATA, *Michelin*. (Plate XIV. fig. 2.)

1847. ***Hallirhoa brevicostata,*** Michelin, Icon. Zooph. p. 127, t. 31. f. 2.
1878. ***Hallirhoa brevicostata,*** Zittel, Studien, II Ab. p. 79.

Sponge in form like a partially opened mushroom, the summit depressed, the sides indistinctly divided into five or six shallow lobes, the stem thick at its junction with the body and gradually tapering. The only example in the collection is 39 mm. in height and 75 mm. in width. This form can hardly be regarded as more than a variety of *H. costata.* It differs from the typical forms of the species in the slight degree in which it is lobed and in the thickened stem. Michelin has erroneously referred *Hallirhoa* (*Polypothecia*) *agariciformis,* Benett, to this variety, but the two forms are very distinct from each other.

Distribution. Upper Green Sand: Warminster, Wiltshire.

HALLIRHOA COSTATA, var. TESSONIS, *Michelin.*

1847. ***Hallirhoa Tessonis,*** Michelin, Icon. Zooph. p. 128, t. 34. f. 1.
1878. ***Hallirhoa Tessonis,*** Zittel, Studien, II Ab. p. 79.

This variety only differs from the typical forms of *H. costata* in the gradual tapering of the body of the sponge to the stem, instead of the sharp constriction usually present between the base of the body and the summit of the stem.

Distribution. Craie Chloritée: Vaches Noires, near Havre (*Tesson collection*).

HALLIRHOA COSTATA, var. ELEVATA, *Hinde.* (Plate XIV. fig. 3.)

In this variety the body of the sponge is formed by five subequal, elongated, compressed lobes; the central portion of the summit is distinctly elevated, with the cloacal aperture at the top. The upper margins of the lobes are separate from each other, and more compressed than the sides. The cloacal aperture is 15 mm. in width. The single example is 110 mm. in height and 100 mm. in width. This variety conspicuously differs from the typical lobed forms of *H. costata* in the elevated summit and in the narrow upper margins of the lobes.

Distribution. Upper Green Sand: Warminster.

HALLIRHOA AGARICIFORMIS, *Benett*, sp. (Plate XV. figs. 1, 1 *a*, 1 *b*.)

1831. *Polypothecia agariciformis*, Benett, Cat. Org. Rem. Wilts. t. 15. f. 1, 2.
1847. *Siphonia acaulis*, Michelin, Icon. Zoophy. p. 139, t. 38. f. 2.
1847. Non *Hallirhoa brevicostata*, Mich. Icon. Zoophy. p. 127, t. 31. f. 2.
1854. *Hippalimus fungoides*, Morris, Cat. Brit. Foss. p. 28.

Sponges more or less depressed, conical, or mushroom-shaped, with generally an even slope from the cloaca to the exterior margin, which is frequently irregular in outline, more or less circular, occasionally thin, and not infrequently with finger- or spur-like processes extending outwards. The under surface of the sponge is hollowed out and intersected with very prominent sinuous ridges, distributed in an irregular manner. In many specimens there are no traces of a stem, and the sponge is apparently sessile; in others, however, there is a small cylindrical process in the centre of the underside, which may represent the upper portion of a slender stem. There is considerable variation in the size of different examples—a small specimen measures 40 mm. in height by 75 mm. in width, and a large form is 80 mm. in height and 155 mm. across the base.

The cloaca is cylindrical and, as a rule, does not extend deep into the body. It is situated at the summit of the cone, its margins are sharp, and its interior surface is covered with the closely set apertures of canals, which, in some examples at least, are disposed in vertical rows. The upper surface of the sponge is covered with numerous, slightly sinuous, branching canals, 1·5 mm. in width, which radiate downwards from the margins of the cloaca towards the exterior edge. These canals are generally open, but were in all probability covered by a dermal layer. In a vertical section canals similar in size and direction to those of the surface are exposed. The basal surface of the sponge exhibits numerous irregularly shaped canal-apertures; there are also indications of a dermal layer extending over the under surface.

The spicules of the interior mesh have robust smooth arms, with tuberculated extremities which interlock together. The arms of the spicules are ·38 mm. in length and ·078 mm. in thickness. A small portion of the surface of a specimen belonging to the Jermyn-Street Museum is covered with a dermal layer of minute, flattened, deeply laciniated spicules about ·65 mm. in width, which are so arranged that their arms overlap each other. These spicules are furnished with shafts which extend into the sponge. I have not been able to detach any of the spicules to ascertain the length of the shaft, but its presence is clearly indicated by the minute aperture which is seen where the heads of the dermal spicules have fallen off the surface. Where this dermal layer is present the surface of the sponge is smooth, and the underlying canals are quite concealed from view.

The examples of this species appear to have been abundant in the Upper Green Sand of certain localities. Miss Benett's figures very accurately represent the outer surface of this species; notwithstanding this, Michelin relegated her forms to his

Hallirhoa brevicostata, which they do not at all resemble. On the other hand, this same author has given the name of *Siphonia acaulis* to an example of this species from Cap la Hève. Examples from this locality in the Museum collection distinctly show the resemblance to specimens from Warminster, in spite of the different aspect resulting from fossilization. This species has also been referred to *Hippalimus fungoides*, Lamx.; but though I have not seen an example of this form, the description and figure of Lamouroux represent an altogether different sponge from the present species.

Distribution. Upper Green Sand: Warminster; Ventnor, Isle of Wight; Cap la Hève, Seine-Inférieure.

Genus JEREA, *Lamouroux*, 1821.

JEREA PYRIFORMIS, *Lamx.*

1821. *Jerea pyriformis,* Lamx. Exp. méthod. p. 79, t. 78. f. 3.
1847. *Jerea pyriformis,* Mich. Icon. Zooph. p. 133, t. 36. f. 3.
1878. *Jerea pyriformis,* Zitt. Studien, II Ab. p. 81.

Distribution. Craie Chloritée: Vaches Noires, Havre.

JEREA WEBSTERI, *Sowerby*, sp., MS.?

1814. *Tulip Alcyonium,* Webster, Trans. Geol. Soc. vol. ii. p. 377, t. 28.
1854. *Siphonia Websteri,* Morris, Cat. Brit. Foss. p. 30.

Sponges pear-shaped or ovate in form, with a conical summit, and gradually tapering to a somewhat slender stem at the base. In none of the Museum specimens has the stem been preserved; but according to Webster's figures it appears to have been unusually long. The body of a small individual is 48 mm. in length by 20 mm. in width, whilst a large specimen measures 81 mm. by 51 mm.

At the summit is a closely arranged group of canal-apertures 1·5 mm. each in width, which open directly at the surface and not in any depression. Down the sides are shown in some specimens longitudinal, sinuous, branching canals. The spicular structure is not clearly exposed.

Prof. Morris quotes Sowerby as the author of this species, but I have not been able to discover the published description.

Distribution. Upper Green Sand: Warminster; Isle of Wight.

JEREA RETICULATA, *Hinde*, n. sp. (Plate XV. figs. 2, 2 *a*, 2 *b*.)

Sponges fig-shaped or subspherical, with slightly truncated summits, either with a short peduncular stem or apparently sessile. A small specimen is 26 mm. in height by 21 mm. in width, whilst a fairly large globular form is 35 mm. in height by 42 mm. in width.

In the shallow depression at the summit of the sponge are the apertures of a group of canals, about 1 mm. each in width. From the summit there extends over the surface a series of canals which apparently anastomose with each other, and give a reticulate appearance to the sponge. In a vertical median section the only canals distinctly shown extend in an arched direction from the surface to the centre of the sponge. These canals appear to be very wide near the outer surface, and to open directly into the reticulate canals. The interspaces of the surface between the reticulations appear to have no other apertures beyond the openings of the spicular mesh.

The interior skeleton is built up of robust spicules with smooth arms and prominent botryoidal nodes at their junction with each other. No dermal layer has been preserved.

This species may be recognized by the reticulated surface and the peculiar character of the canals extending from it to the centre of the sponge.

Distribution. Upper Green Sand: Warminster, Blackdown; Cap la Hève; Retsel, Ardennes. Craie Chloritée: Honfleur, Vaches Noires. Gault? near Folkestone.

JEREA QUENSTEDTI, *Zittel.*

1878. *Jerea Quenstedti,* Zitt. Studien, II Ab. p. 81, t. 10. f. 2.
1878. *Siphonia ficus,* Quenst. Petref. Bd. 5, p. 431, t. 135. f. 20–23.

Microscopic slides with spicules of this species.

Distribution. Quadraten-Kreide: Linden, Hanover.

JEREA CORDIFORMIS, *Hinde*, n. sp. (Plate XV. figs. 3, 3 *a*.)

Sponge obcordate in form, with an evenly rounded summit, constricted at the base, and apparently supported on a stout stem. The only specimen in the collection is 93 mm. in height and 73 mm. in width.

The somewhat elongated rounded ridge at the summit is pierced by numerous apertures of the vertical series of canals, 2 mm. in width. From the summit also, open, sinuous, branched canals extend down the sides of the sponge. The canals extending from the surface towards the interior are greatly arched, and 1 mm. in width.

As is usual in all the specimens from the Grey Chalk, no spicules have been preserved in this form, but prominent junction-nodes can be recognized; and I have no doubt that the sponge belongs to the Tetracladina family.

In its peculiar form and in the character of the summit this sponge is distinct from any hitherto referred to this genus.

Distribution. Grey Chalk: near Dover.

JEREA EXCAVATA ?, *Michelin.*

Jerea excavata, Michelin, Icon. Zooph. p. 135, t. 39. f. 2.
Jerea excavata, Zittel, Studien, II Ab. p. 81, t. 10. f. 1.
Rhysospongia pictonica, Court. Ep. foss. t. 1. f. 1, 2.

Sponge massive, hemispherical, the upper surface slightly concave, the under surface rounded, apparently sessile. Height 70 mm., width 138 mm.

Numerous canal-apertures, 3·5 mm. in width, open into the shallow depression of the summit and also on the sides. The only specimen is a solid mass of flint which merely retains the outer form and the canal-apertures. In the absence of the spicular structure, it can only be doubtfully referred to Michelin's species.

Distribution. Upper Chalk: Wiltshire.

Genus NELUMBIA, *Pomel*, 1872.

NELUMBIA TUBEROSA, *Hinde*, n. sp. (Plate XVI. figs. 1, 1 *a*, 1 *b*, 1 *c*.)

Sponge club-shaped, with an irregularly truncated summit, gradually tapering at the basal end to form root-like processes. A few irregularly scattered nodose projections are present on the surface. Length 180 mm., width 34 mm.

Numerous circular or polygonal canals, 3 mm. wide, open at the summit, and extend vertically nearly to the base of the sponge. Another series of canals, 1 mm. wide, extend from the lateral surfaces, in a slightly arched direction, to the central portion of the sponge.

The spicules of the interior mesh, though now replaced by calcite, can be fairly recognized. They appear to possess smooth robust arms, ·27 mm. in length by ·045 mm. in width, and prominent junction-nodes. The surface appears to have been completely covered with a delicate dermal layer principally composed of the horizontally extended heads of trifid spicules with bifurcate, straight, pointed rays. Some of the spicular heads are ·6 mm. in width.

In the size and form of the specimen itself, and of the canals, this species differs from the different forms figured by Courtiller* under the name of *Polystoma*, which have been placed by Pomel as the types of the genus *Nelumbia*. In Pomel's† definition it is stated that the vertical canals do not penetrate deeply below the summit of the sponge; but, as already indicated by Zittel, it seems very probable that he is mistaken on this point, for in the figures of the type species the canals are shown, in the section of at least one specimen, to extend to the basal portion of the sponge.

Distribution. Grey Chalk: near Dover. Upper Chalk: South of England.

* Eponges fossiles, p. 10, t. 15.
† Paléontologie d'Oran, p. 194.

Genus POLYJEREA, *Fromentel emend. Zittel.*

POLYJEREA ARBUSCULA, *Hinde*, n. sp. (Plate XVI. figs. 2, 2 *a*.)

Sponge massive, growing from a simple, compressed stem, from which spring upright, straight, or slightly curved, cylindrical, compressed, or club-shaped branches, which also subdivide. The branches are mostly separate, but occasionally coalesce together; they average 36 mm. in thickness. At the summit of the branches are the apertures of numerous canals, about 2 mm. in width, which extend vertically down the branches. The lateral surfaces are covered with smaller apertures of canals, 1 mm. in width, which extend towards the centre of the branch.

The spicules of the interior mesh have smooth arms and prominent nodes. Occasionally traces of the dermal layer are preserved; it consisted, in part at least, of trifid spicules, with horizontal heads of pointed rays, similar to those of *Nelumbia tuberosa.*

I am unable to determine how far this species differs from *Polyjerea ramifera*, Zitt.*, in its mode of growth. By the form and disposition of the branches it may readily be distinguished from *Polyjerea gregaria*, Mich.† sp.

Distribution. Upper Green Sand: Warminster. Grey Chalk: near Dover.

POLYJEREA LOBATA, *Hinde*, n. sp. (Plate XVI. fig. 3.)

Sponge consisting of a compact group of fig- or barrel-shaped, or occasionally cylindrical individuals, growing from a flattened base or from a slight peduncle. The outer surface of the group is partially lobed, but in the central portion the individuals are closely amalgamated together; the summits are, however, free. The number of individuals in each compound mass varies between six and twenty. In size the compound form is from 90 to 105 mm. in width, and about 64 mm. in height.

The summit of each individual is truncate, or has a slight shallow depression; the canals opening at the summit are 2 mm. in width, and extend nearly to the base of the sponge. The spicules of the interior mesh have been replaced by calcite in the specimens from the Grey Chalk; in the forms from the Upper Green Sand they have relatively short, smooth arms and prominent junction-nodes. Only traces of a dermal layer have been preserved; it resembles in the form of its larger spicules that of the last species.

Distribution. Upper Green Sand: Warminster. Grey Chalk: near Dover.

Genus BOLOSPONGIA, *Hinde*, n. g.

Sponges subspherical or elongate and lobate. No regular series of canals is present; in the rounded forms there are interior loculi which communicate with the

* Studien, II Ab. p. 83. † Icon. Zooph. p. 134, t. 38. f. 1.

exterior by wide channels; in the elongate examples the lobes are deeply constricted, and no definite canals are apparent. The spicular mesh of the interior is composed of four-rayed spicules, with apparently smooth arms and prominent nodes at their junction with each other. A dermal layer is partially preserved, but its component spicules are not recognizable.

I propose this genus for a small group of sponges which, in external form, closely resemble certain species of *Astrobolia*, Zittel. In this genus, however, the spicules are of the *Rhizomorine* type, whereas in *Bolospongia* they are distinctly *Tetracladinæ*. The specimens are from the Upper Chalk of Flamborough, and, in common with all the examples from this locality, their spicular structure has been mostly destroyed.

BOLOSPONGIA GLOBATA, *Hinde*, n. sp. (Plate XVII. figs. 1, 1 *a*, 1 *b*.)

Sponges subspherical, closely resembling a potato in form, the surface uneven, with slight rounded elevations and intervening depressions; in some examples there is a minute peduncle not more than 5 mm. in length; other specimens are apparently entirely free. An average example is 45 mm. in diameter.

On the surface of specimens which have been treated with acid there are exhibited in places small circular apertures about 2·5 mm. in width, and occasionally a few canals radiate from these over the surface. In a vertical section irregular channels, 6 mm. wide, and open spaces are exposed. The spicules have been replaced by crystalline calcite and silica, but their rough outlines can be distinctly seen in thin sections. The arms are relatively large and robust, ·315 mm. in length by ·067 mm. in width; some of the nodes are ·27 mm. in thickness.

Distribution. Upper Chalk: Flamborough, Yorkshire.

BOLOSPONGIA CONSTRICTA, *Hinde*, n. sp. (Plate XVII. fig. 2, 2 *a*.)

Sponge elongate, consisting of a series of irregularly shaped lobes, the constrictions between which extend to the central portion of the sponge. There are a few traces of surface-canals; oscules are not apparent, and the circulation seems to have been carried on in the channels between the lobes. The spicular mesh is of a loose, open character; the spicules are similar to those of *B. globata*. A compact dermal layer apparently covered the outer surface, but the form of its spicules cannot be recognized.

There is but one specimen of this singular sponge in the Collection. It is 108 mm. in length by 42 mm. in width.

Distribution. Upper Chalk: Flamborough.

Genus THECOSIPHONIA, *Zittel*, 1878.

THECOSIPHONIA NOBILIS, *Rœmer*, sp. (Plate XVII. figs. 3, 3 *a*.)

1864. *Limnorea nobilis*, F. A. Rœmer, Palæont. Bd. 13, p. 37, t. 15. f. 1.
1878. *Limnorea nobilis*, Quenst. Petref. Bd. 5, t. 133. f. 8–11.
1878. *Thecosiphonia nobilis*, Zittel, Studien, II Ab. p. 84.

The only example of this species is a compound form, 72 mm. in height by 90 mm. in width, consisting of three individuals closely aggregated together, and united by a common dermal layer. The individuals are roughly ovate in form; they appear to have had one or two cloaca-like depressions on the summit; the canal-structure of the interior has been destroyed. Some of the spicules of the interior mesh can be seen; they are relatively very large, the arms and nodes measuring ·5 mm. in length; the nodes are very prominent.

The dermal layer is thin, and grows in concentric, wrinkled bands; it appears to have originally extended all over the sponge, with the exception of the summit; its surface is smooth, and contrasts strongly with the rough furrowed character of the summit. I have been unable to determine the form of the spicules composing this membrane.

Distribution. Upper Chalk: Wiltshire (*Cunnington coll.*). The example belongs to the Jermyn-Street Museum.

THECOSIPHONIA TURBINATA, *Hinde*, n. sp. (Plate XVII. fig. 4.)

Sponge turbinate in form; the upper portion or body is depressed, conical, with a wide base supported on a short, oblique, obtusely terminated stem. The base is concentrically furrowed and wrinkled, and carries one or two short radical processes. The single example is 85 mm. in height and 100 mm. in width.

The upper surface of the sponge is rough; the cloaca at the summit is 26 mm. in width, and does not appear to have been deep; from its margins sinuous branching canals radiate over the surface. The interior canals have been destroyed.

Only here and there can the four-rayed spicules of the mesh be detected; they are smaller than those of *T. nobilis*. The under surface and the stem appear to have been completely covered with the dermal layer, but its spicular elements cannot be recognized.

The only specimen is now a mass of flint, in which only the outer form, the dermal layer, and a few of the interior spicules are preserved. In its form and in the restriction of the dermal layer to the basal portion it differs from *Thecosiphonia* (*Tremospongia*) *grandis*, Rœmer*.

Distribution. Upper Chalk: Stockton, near Heytesbury, Wiltshire.

* Palæontogr. Bd. 13, Taf. 15. fig. 3*c*.

Genus CALYMMATINA, *Zittel*, 1878.

Calymmatina rimosa, *Zittel*.

1878. *Calymmatina rimosa,* Zittel, Studien, II Ab. p. 85, t. 2. f. 2, and t. 9. f. 8.

There is a single specimen in the Collection which, so far as can be determined from its imperfect preservation, appears to belong to the above species. Nothing is known as to the locality whence it comes; judging from the matrix it would seem to have been derived from the Upper Chalk.

Genus TURONIA, *Michelin*, 1847.

Turonia variabilis, *Michelin*. (Plate XVIII. fig. 1.)

1847. *Turonia variabilis,* Mich. Icon. Zooph. p. 126, t. 35. f. 1–8.
1861. *Turonia variabilis* et *sulcata,* Court. Eponges foss. p. 25, t. 40. f. 1–3.
1878. *Turonia variabilis,* Zittel, Studien, II Ab. p. 86.

Sponges conical in form, with a flattened or rounded base, from which one or more radical processes project. A small example is 21 mm. in height by 25 mm. in width; another specimen is 52 mm. in height by 42 mm. in width.

The upper, distinctly conical portion of the sponge has a tubular cloaca, which opens at the summit of the cone; the sides are rough and deeply furrowed with open canals, which radiate downwards from the edge of the cloaca; in these canals are occasionally seen the apertures of smaller canals, which penetrate to the interior of the sponge. The lower margin of the upper cone overlaps slightly the upper portion of the base, and is usually distinctly marked off from it by a well-defined furrow. The basal portion is smooth and compact.

The mesh-spicules have robust arms and branching extremities. The dermal layer is partly composed of very minute irregular-shaped spicules, and partly of minute trifid spicules with delicate horizontally expanded head-rays.

This species is rare in this country. I have only seen two imperfect examples; it appears to be abundant in the neighbourhood of Tours. The specimen figured is probably from France; the particular locality is unknown.

Distribution. Upper Chalk: Flamborough, Yorkshire; South of England; France.

Genus KALPINELLA, *Hinde*, n. g.

Sponges simple, cup- or vase-shaped, supported on a cylindrical or compressed stem, with root-like processes at its termination. Margins rounded. Both the interior and exterior surfaces of the sponge-wall with numerous canal-apertures. The canals are somewhat sinuous and extend through the wall at right angles or obliquely to the surface. Vertical canals also extend down the stem.

The mesh-structure of the interior is relatively close, composed of small four-rayed spicules with short, robust, smooth arms, and branching tuberculated extremities. No dermal layer has been preserved.

I place in this genus a group of sponges which in form closely resemble some species of *Chenendopora*, and can only be distinguished therefrom by an examination of the spicular structure, which is distinctly Tetracladine. The absence of the dermal layer prevents a comparison with the recent genus *Discodermia*; there is hardly a doubt that the fossil forms were originally furnished with a surface-layer; and should future discovery show that its spicular structure resembles that of *Discodermia*, the present genus will have to be relinquished, as the interior spicular structure is very similar to that of the recent genus.

With one doubtful exception from the Grey Chalk, all the sponges of this genus come from the Upper Green Sand, and, in common with most of the examples from the same beds, retain the spicular mesh of the interior in good preservation, but the minute structure of the exterior surface is obliterated.

KALPINELLA PATERÆFORMIS, *Hinde*, n. sp. (Plate XVIII. fig. 4, and Plate XIX. figs. 1, 1 *a*, 1 *b*.)

1831. *Polypothecia expansa*?, Benett, Cat. Org. Rem. Wilts. t. 6. f. 2.

Sponges cup-shaped, in some cases shallow and expanded, in others moderately deep. The stem is either short and compressed or elongated and cylindrical. The margins of the cup are rounded, and sometimes exhibit open canals. The wall varies between 12 and 18 mm. in thickness in different specimens. A small example is 70 mm. in width across the cup, and a large specimen 110 mm. The longest stem preserved measures 93 mm.

The canal-apertures are from 1 to 1·5 mm. in width; they are nearly equal in size, so far as can be ascertained, on both the upper and under surfaces of the cup-wall; in some specimens the canals of the under surface open very obliquely downwards.

The spicular rays of the interior are very irregular in length, and from ·02 to ·04 mm. in thickness. The extremity of the rays is developed into a bunch of tubercles, and by the interlocking of the tubercles of adjoining rays the mesh is built up. In some of the spicules the canals of the interior are still preserved; they extend from the centre of the spicule to about half or two thirds the length of the arms, and appear as very minute cylindrical tubes.

In external form some of the specimens resemble the *Polypothecia expansa*, Benett; but in the absence of all description of the internal structure of this species, I have deemed it best to place these forms under a fresh designation.

Distribution. Upper Green Sand: Warminster. Doubtfully from the Grey Chalk near Folkestone.

KALPINELLA RUGOSA, *Hinde*, n. sp. (Plate XIX. fig. 2.)

Sponge massive, expanded cup- or vase-shaped, with corrugated and folded walls in the upper portion of the cup, the under surface either smooth or with nodose outgrowths. Only the upper portion of the simple cylindrical stem preserved. The walls vary from 17 to 23 mm. in thickness. A fairly large specimen is 230 mm. wide at the summit of the cup, and 110 mm. in height.

The canal and spicular structures resemble those of the last species, from which this is mainly distinguished by its thicker and folded walls and its larger dimensions.

Distribution. Upper Green Sand: Warminster, Burbage, Wiltshire.

Genus THAMNOSPONGIA, *Hinde*, n. g.

Sponges growing in the form of simple upright branching stems, or forming bush-like masses. The branches cylindrical or rarely compressed.

With the exception of one species, in which canals do not appear to be present, these sponges are traversed longitudinally by one or more canals.

The interior skeleton forms a close mesh, composed of very minute spicules with short stumpy arms. The arms are covered with relatively large prominent tubercles, in such a manner that they appear in some instances to be made up of closely set tubercles or rings. These spicules appear to be connected together either by the interlocking of the tubercles of adjoining spicules or by the adpression of the extremities of the spicular arms, but they do not form distinct nodes at their points of junction with each other.

I propose this genus for a group of sponges which closely resemble, as regards their form and mode of growth, some species of *Polyjerea* and *Astrocladia*, but present a very different form of mesh-spicule. In both these last-named genera the spicules of the mesh have smooth arms and form prominent junction-nodes; but in the present genus the spicules are tuberculated throughout, and the nodes are inconspicuous. The characters of the dermal layer also vary from those of *Astrocladia*, in which no regular trifid spicules are present, whilst these form well-recognized features in the dermal layer of this genus. The character of the interior spicules, and their mode of union with each other, exhibit some similarity to the spicular structure in *Plinthosella*; but the mesh is much closer and the spicules are far smaller than in any sponge of that genus, whilst the form of the spicules of the dermal layers is altogether distinct.

The examples of this genus appear to be abundant in the Upper Chalk, and they usually occur in the interior of flints, frequently loose, so that when the flint is broken the sponge may be extracted. As a rule, the interior skeletal structure is destroyed, but the dermal layer is partially preserved, and the spicules in it can be determined. I refer, provisionally, to this genus also a specimen from the Grey

The stems vary from 7 to 14 mm. in thickness, and reach to a length of 110 mı The branches are from 4 to 9 mm. in thickness.

The canal-structure is mostly obliterated; but in some specimens four or fi longitudinal canals, ·6 mm. in width, are exposed in the broken ends of a branch. T spicular mesh appears to be of the same character as in *T. glabra*, but the spicul are somewhat larger. The dermal layer is only partially preserved; the larger tri heads are ·6 mm. in extension, and thus double the size of those in *T. glabra.*

This species is also very common in Chalk flints; the short branches, usual single stem, generally rough exterior, and the larger size of the spicules of t dermal layer readily distinguish it from *T. glabra.*

Distribution. Upper Chalk: Chicklade, near Hindon; Stockton, near Heytesbur Warminster, Wiltshire; Dover.

THAMNOSPONGIA? RETICULATA, *Hinde*, n. sp. (Plate XVIII. figs. 3, 3 *a*, 3 *b*.)

Sponge consisting of a group of closely arranged, cylindrical or compressed sten growing in an upright direction, and frequently coalescing. The summits are conic The stems are from 10 to 16 mm. in thickness. An imperfect example is 100 mı in height and 80 in width.

Each stem is traversed longitudinally by a single cylindrical canal, 3·5 mm. i width, into which sinuous radial canals, horizontal or slightly arched, and ·5 mm. width, open. The exterior surface, when the dermal layer is absent, is cover with a network of reticulated canals. At the summit of the individual stems a the openings of the vertical canals, which thus appear to have served as cloac tubes.

The spicules of the interior have been replaced by calcite, and are too indistin for the presence or otherwise of the tubercles to be determined. The arms measu ·135 mm. in length by ·038 mm. in width. Traces of the dermal layer remain; tl spicules composing it are of the same character as those of *T. glabra.*

In the absence of a satisfactory determination of the mesh-spicules, I can on refer this form provisionally to this genus. Its mode of growth readily characteriz it from the previous species.

Distribution. Grey Chalk: near Folkestone.

Genus PHOLIDOCLADIA, *Hinde*, n. g.

Sponges growing in bushy masses, consisting of cylindrical branching stems. N canal-structure apparent.

The interior skeletal mesh is composed of minute tetracladine spicules, wit strongly tuberculated or annulated arms, and apparently small twig-like extensio at their ends, which grasp the arms of adjoining spicules without forming distincti

in the one figured; but whether these were originally filled with sponges with yet slenderer stems than the present form I am unable to determine, for no fragments of the sponges remain.

Distribution. Upper Chalk: South of England.

Genus RAGADINIA, *Zittel*, 1878.

The typical and, up to the present, only described species of this genus, *Ragadinia rimosa*, Rœmer*, sp., consists of ear- or platter-shaped sponges, with a short lateral stem and thick walls. There are in the Museum collection several species of sponges which correspond with the typical form of Zittel in the interior spicular structure, and also in the spicular structure of the dermal layer and in the characters of the canals, but differ in their exterior form. These sponges are either cup- or vase-shaped, or irregularly club-shaped. As these sponges are similar in the important features of their spicular and canal-structures, I propose to extend Zittel's definition of the genus so as to include sponges of the above-mentioned forms.

RAGADINIA RIMOSA, *Rœmer*, sp.

1864. *Cupulospongia rimosa*, F. A. Rœmer, Palæont. Bd. 13, p. 51, t. 17. f. 8.

1878. *Ragadinia rimosa*, Zittel, Studien, II Ab. p. 88, f. 4 *a–f*; and Handbuch, p. 166, f. 79.

Microscopic slides of the interior spicules and of the spicules of the dermal layer, from Professor Zittel.

Distribution. Upper Chalk: Ahlten, Hanover.

RAGADINIA COMPRESSA, *Hinde*, n. sp. (Plate XIX. figs. 3, 3 *a*.)

Sponges vase- or funnel-shaped, frequently compressed, though some examples are open and shallow, supported on a short stout stem, which is attached to some foreign object at its termination. Not infrequently there are nodose outgrowths in the lower part of the cup. Walls comparatively thick, varying from 10 to 13 mm. The margins are rounded, and occasionally show fine, transverse, open canals. The specimens are from 80 to 113 mm. in height, and about the same in breadth at the summit of the cup.

The upper or interior surface of the cup is furrowed irregularly by minute open canals; the under surface exhibits also a series of delicate canals with a downward direction. These canals are only apparent in some specimens: usually the outer surface has numerous apertures of canals, 1 mm. in width, which open very obliquely to the surface.

The spicules of the interior mesh are minute and very characteristic in form. One of the four arms merely consists of a prominent tubercle; the other three arms have

* Palæontographica, Bd. 13, p. 51, t. 17. f. 8.

ring-like swellings near their centres, and at their distal ends split up irregularly into small twigs, by which they are interlocked together, but they do not appear to form prominent nodes at the point of junction of the arms. The outer surface of the sponge, where the dermal layer is not present, shows, under a strong lens, the tubercled spicular arm projecting outwards. The body-spicules of this species are exactly similar to the detached spicules discovered in the Trimmingham Chalk by Professor Sollas *, and named by him *Compsapsis cretacea*, and in the Chalk flint at Horstead by myself, and named *Ragadinia annulata* †. As, however, these remarkable body-spicules are not peculiar to a single species of sponge, the names given to the detached spicules cannot be applied to the present or the following forms in which they occur.

A dermal layer is present in some portions of the outer surface of the specimens, and probably originally extended over the entire sponge. It is composed of the horizontally expanded heads of shafted spicules, about ·3 mm. in width, which are deeply lobed and laciniated. These heads overlap each other so as to form a connected membrane with a smooth surface. Some of the detached dermal spicules from the Horstead Chalk flint ‡, which I referred to *Ragadinia annulata*, probably belong to the present species. These dermal spicules also very closely resemble those of the existing *Corallistes asterodiscus*, O. Schmidt; but from an examination of microscopic specimens of this sponge, labelled by Schmidt himself, I have ascertained that its body-spicules are different from those of the present species.

Distribution. Upper Chalk: Oare, Huish, Wiltshire (*Cunnington coll.*).

RAGADINIA SULCATA, *Hinde*, n. sp. (Plate XX. figs. 1, 1 *a*.)

Sponges cup- or funnel-shaped, frequently with only a shallow interior depression. They gradually taper to a short, straight or oblique, cylindrical stem, with root-like processes at its termination. Sometimes there are small nodose projections near the rounded margins of the cup. The walls of the cup vary from 6 to 8 mm. in thickness. The specimens are from 70 to 90 mm. in height and about 55 mm. in width at the summit.

Both the outer and inner surface of the sponge is traversed by numerous open canals, about ·5 mm. in width, frequently disposed side by side, and running in an oblique direction, thus giving the surface a furrowed aspect. In addition to the surface-canals there are others extending into the wall and apparently opening into the surface-canals.

The interior spicular skeleton is composed of spicules of the same annular character, but larger than those of *Ragadinia compressa*; mingled with these there are

* Annals & Mag. Nat. Hist. 5th ser. vol. vi. 1880, p. 387, pl. 19. figs. 21, 22.

† Fossil Sponge-Spicules, 1880, p. 58, pl. 5. figs. 1–4.

‡ Fossil Sponge-Spicules, pl. 4. figs. 24–30.

also exposed on the surface elongated irregular filiform spicules. The entire sponge appears to have possessed a smooth dermal layer of horizontal spicules with laciniated arms; these heads are about ·9 mm. in width. I have not been able to discover the character of the shafts of these spicules.

This species differs from the two preceding, not only in its outer form, but in the larger size of the body- and dermal spicules.

Distribution. Upper Chalk: Beckhampton, Wiltshire (*Cunnington coll.*).

RAGADINIA CLAVATA, *Hinde*, n. sp. (Plate XIX. figs. 4, 4 *a*, 4 *b*, 4 *c*.)

Sponges irregularly rod- or club-shaped, often with stumpy processes and nodose outgrowths. Very variable in size, sometimes reaching to 100 mm. in height and from 13 to 31 mm. in thickness.

The surface appears to have been covered with a smooth dermal layer; where this is absent, surface-canals, about ·6 mm. in width, are exposed, closely seaming the exterior of the sponge.

The interior skeleton is composed of distinctly annulated spicules similar to those of *R. compressa*. The spicules of the dermal layer have narrow laciniated head-rays; they are about ·5 mm. in extension, and so disposed that there are minute interspaces between the rays or arms. When the spicules have fallen from the surface of the sponge, it often happens that the material filling these small interspaces stands out as so many minute tubercles.

This species is readily distinguished from others of the genus by its peculiar form. All the examples have been procured from the interior of flints, and only the spicules of part of the dermal layer and the spicular structure immediately beneath this layer have been preserved.

Distribution. Upper Chalk: Wiltshire (*Cunnington coll.*).

Genus PLINTHOSELLA, *Zittel*, 1878.

This genus was founded on small, spherical, or irregular nodose sponges, from 5 mm. to 25 mm. in thickness, with an interior skeletal mesh of large irregularly four-armed tuberculated spicules, and a dermal layer composed of small scaly disks of irregular form. In the Museum collection and in the Jermyn-Street Museum there are cup-shaped, rod- or club-like, and convoluted sponges with an interior skeletal mesh closely resembling that of *Plinthosella squamosa*, Zitt., the type of the genus. The spicules of the dermal layer of these sponges, however, vary in detail from those of the type species, for they are usually disk-like with jagged edges, or even occasionally lobate. This variation is not sufficient, however, to be regarded as a basis for generic distinction, for in a single specimen of the typical species there may be found great diversity in the form of the disks of the dermal layer.

The spicular structure of the interior closely resembles that of *P. squamosa.* No dermal layer has been preserved.

I have only seen one example of this species, which is from the interior of a flint. Notwithstanding the absence of a dermal layer, I have but little doubt of the propriety of placing it in this genus on account of the close resemblance of the interior-mesh spicules to those of the type species. The specimen in question belongs to the Jermyn-Street Museum.

Distribution. Upper Chalk: Wiltshire (*Cunnington coll.*).

Plinthosella nodosa, *Hinde*, n. sp. (Plate XX. figs. 4, 4 *a.*)

Sponges simple, rod- or club-shaped, with irregular nodose and spur-like projections. A fairly large specimen is 100 mm. in height and 80 mm. wide.

The surface of the sponge, where the dermal layer is not present, is traversed by sinuous canals from ·5 to 1 mm. in width. The interior structure is obliterated, so that I am unable to determine if interior canals are present.

The spicules of the interior mesh resemble those of *P. squamosa,* but they are somewhat smaller. The surface is covered with a dermal layer of disciform spicules (about ·6 mm. in width), very variable in figure, some being deeply lobed like those of *Ragadinia,* whilst others are circular disks with merely jagged edges. These spicules overlap each other in such a manner as to produce a compact, smooth surface-layer.

In some respects this species exhibits characters similar to those of *Ragadinia*; and without an examination of the spicular structure, it might readily be confounded with *R. clavata.* As the spicules of the interior skeleton are of the same type as *Plinthosella squamosa,* it appears to me to belong rather to this genus than to *Ragadinia.* The variable character of the spicules of the dermal layer is well exhibited in this species, for in close proximity to each other on the surface there are nearly plain disks and deeply-lobed branching spicules.

Distribution. Upper Chalk: Wiltshire (*Cunnington coll.*).

Plinthosella convoluta, *Hinde*, n. sp.

Sponge growing as an irregularly convolute plate from 5 to 5·5 mm. in thickness. The only specimen, which is incomplete, is 110 mm. in height and 82 mm. in lateral extension.

It is doubtful whether canals are present in the sponge-wall. The skeletal mesh is composed of spicules closely resembling in size and form those of *Plinthosella compacta.* The dermal layer is absent; but in one small portion of the outer surface there are a few minute scaly spicules which may represent part of the former external layer.

This species very closely resembles, in its mode of growth, *Phymaplectia irregularis*;

and in the absence of the dermal layer, the main point of distinction between these forms consists in the much larger size of the interior spicules of the present species; when the dermal layer is present, the difference between the scaly spicules and the trifids of *P. irregularis* at once distinguishes these forms from each other.

Distribution. Upper Chalk: Wiltshire.

Genus PHYMAPLECTIA, *Hinde*, n. g.

Sponges with plate-like walls, palmate or digitate, or, by the coalescing of the margins of the convolute walls, becoming cup- or funnel-shaped. Canal-system but slightly developed, the circulation apparently being carried on through the openings of the spicular mesh. The interior skeleton is composed of irregular tuberculated spicules of the same type as in *Plinthosella* and *Spongodiscus*, which are connected together by the interlocking of minute twig-like extensions at the ends of the arms, or by the apposition of adjoining spicules. A dermal layer is usually present, and is chiefly composed of trifid spicules with minute, horizontally expanded, and slightly bifurcated head-rays.

The character of the dermal layer distinguishes this genus from *Plinthosella*; in form and mode of growth it differs from *Spongodiscus*, Zitt. At present no dermal layer has been discovered in sponges of this latter genus, although there is hardly a doubt that one was present originally.

The forms of the genus at present known are all from the Upper Chalk.

Phymaplectia irregularis, *Hinde*, n. sp. (Plate XXI. figs. 1, 1 *a*.)

Sponges growing in upright fan-like, semipalmate, or digitiform expansions, or occasionally, by the involution of the wall-plate and the coalescence of the margins, becoming cup-shaped. The margins of the wall are rounded; at the base there are traces of root-like extensions. The specimens are from 100 to 120 mm. in height; the walls are between 5 and 7 mm. in thickness.

No canal-system is apparent, but the condition of the specimens is such that it is impossible to determine whether canals were originally present or not. The interior spicular mesh is composed of irregular warty spicules, the arms of which are from ·2 to ·3 mm. in length. A smooth dermal layer apparently covered the entire outer surface of the sponge-wall, though only portions of it now remain. It is made up of trifid spicules with horizontal heads; the rays are slightly compressed and regularly bifurcated. The heads of the larger spicules are between ·4 and ·5 mm. in expansion. The character of the shafts is not shown.

All the examples of this species are preserved in the interior of flints. In outer form they somewhat resemble the figures of *Polypothecia palmata* and *P. fissa*, Benett*; but in the absence of all knowledge of the minute structure of these

* Cat. Org. Rem. County of Wilts, pl. 11. f. 2, and pl. 12.

sponges, I am unable to determine whether the resemblance is more than in outer form.

Distribution. Upper Chalk: Wiltshire.

PHYMAPLECTIA SPINOSA, *Hinde*, n. sp. (Plate XXI. figs. 2, 2 *a*.)

Sponges with convolute walls, from 5 to 7 mm. in thickness, which coalesce at their margins and become funnel-shaped. The margins are rounded; the basal portion has not been preserved. The exterior surface is furnished in places with small, straight spinous processes. A specimen is 92 mm. in height, and the same in width at the summit.

Traces of sinuous canals, ·5 mm. in width, are apparent in one part of a specimen, but I cannot determine if these are generally present. The interior spicular mesh is of the same character as in the preceding species, but the spicules are somewhat more robust. The outer surface retains in places the smooth dermal layer; the spicular heads of which it is formed are about ·25 mm. in extension. The inner surface of the cup is not exposed.

This species approaches very closely to *P. irregularis*, but the spicules of its interior mesh are somewhat larger, and those of the dermal layer smaller, than in the last-named species. The specimen figured belongs to the Jermyn-Street Museum.

Distribution. Upper Chalk: Wiltshire (*Cunnington coll.*).

PHYMAPLECTIA CRIBRATA, *Hinde*, n. sp. (Plate XXI. figs. 3, 3 *a*.)

Wall-plate of sponge growing in wavy folds, showing also slight concentric, rounded ridges on the outer surface. The wall is from 4 to 5 mm. in thickness. The basal portion of the specimen is not preserved. The imperfect example is 82 mm. in height and 112 mm. in width.

The spicules of the interior mesh are very closely tuberculated; the arms are about ·4 mm. in length, and more robust than in the preceding species. The outer surface of the sponge-wall is covered with a smooth dermal layer, which is penetrated with numerous minute pores about ·1 mm. in diameter, and only visible under a good lens. The dermal layer between these pores is in part composed of extremely minute trifid spicules, the head-rays of which are about ·1 mm. in extension, in part of apparently irregular spicular bodies, whose forms are not sufficiently well-preserved for determination.

The mode of growth, and more particularly the characters of the dermal layer, readily distinguish this species from the preceding. The only specimen known is from the interior of a flint. It belongs to the Jermyn-Street Museum.

Distribution. Upper Chalk: Wiltshire (*Cunnington coll.*).

PHYMAPLECTIA SCITULA, *Hinde*, n. sp. (Plate XXII. figs. 1, 1 *a*, 1 *b*.)

Sponge funnel-shaped, open below, apparently formed by the coalesced margins of a convolute plate. The walls thin and delicate, between 2·8 and 3·5 mm. in thickness. The only specimen is 38 mm. in height, and 74 mm. in its greatest width.

The interior of the funnel is marked by very slight elevated spots about 5 mm. apart, towards which closely set minute, radial, open canals, about ·4 mm. in width, concentrate. No distinct aperture is to be seen at the centre of these elevations; the radial canals round some of them are but very faintly marked.

The spicular mesh is formed of relatively large, closely tuberculated spicules with arms about ·35 mm. in length. Very minute spicular bodies also appear to be present between the mesh-pores of the larger spicules, but they are too indefinite for determination. No dermal layer has been preserved.

The thin delicate walls and the surface-canals of the interior characterize this species. I have only seen a single example, preserved in flint, which belongs to the Jermyn-Street Museum.

Distribution. Upper Chalk: Wiltshire (*Cunnington coll.*).

Genus RHOPALOSPONGIA, *Hinde*, n. g.

Sponges simple or aggregate, club-shaped, with rounded or flattened summits; stem simple, with, in some cases, root-like prolongations.

Neither cloaca nor prominent canals are present; the sponge is traversed by curved canals of moderate dimensions, which extend from the central portions and open at the surface. Longitudinal canals are present in the stem.

The spicular tissue is composed, for the most part, of relatively large tuberculated spicules, with straight or curved arms, which connect with adjoining spicules by the interlocking of their tuberculated extremities. In these spicules the tetracladine character can hardly be recognized, but mingled with them in the mesh there are regularly four-armed spicules with smooth arms and tuberculated extensions. No dermal layer has been preserved.

The mode of growth, character of the canal-system, and the interior spicular structure readily distinguish this genus. In the tuberculate character of the spicules, it resembles *Plinthosella*, *Spongodiscus*, and *Phymaplectia*; but, so far as I am aware, in none of these genera are smooth-armed spicules mingled with tuberculate forms.

At present I have recognized two species belonging to this genus, both of which are from the Upper Green Sand.

RHOPALOSPONGIA GREGARIA, *Benett*, sp. (Plate XXII. figs. 2, 2 *a*, 2 *b*, 2 *c*.)

1831. *Polypothecia gregaria,* Benett, Cat. Org. Rem. County of Wilts, t. 14.

1847. Non *Jerea gregaria,* Michelin, Icon. Zooph. p. 134, t. 38. f. 1.

Sponges elongate, club-shaped, with rounded conical summits, either simple or growing in groups of three or four individuals of different sizes, closely attached by their lateral surfaces. Rarely, also, two individuals possess a common stem. The outer surface of the body, or club-shaped portion, is either smooth and evenly rounded, or with irregular nodose projections, or covered with small pustular elevations. The cylindrical stem frequently exhibits parallel longitudinal furrows; it appears to have given off root-like processes at its termination. Small individuals measure 55 mm. in height and 14 mm. in width; whilst a large example is 300 mm. in length by 45 mm. in width.

The outer surface of the sponge is thickly covered with canal-apertures from ·5 to ·75 mm. in width. These canals apparently extend in an arched direction towards the centre of the sponge; in a transverse horizontal section only a few of the larger canals are distinguishable. Both in vertical and horizontal sections distinct lines of growth parallel with the contour of the sponge are exposed.

The spicular mesh is relatively close; the smooth arms of the regular spicules are ·06 mm. in width, whilst the tuberculated arms measure ·08 mm. wide. The regular spicules are indiscriminately mingled with the others; they appear, however, to be more frequent in the central portion of the sponge, whilst the irregular tuberculated spicules prevail nearer the outer surface. Interior canals are preserved in many of the spicules. This species is not uncommon in the Upper Green Sand.

There can be no doubt that Miss Benett's figure represents this species, particularly as there is no other sponge from the Green Sand with a corresponding form. Michelin has referred this species to his *Jerea gregaria,* with which, however, it has no near affinity.

Distribution. Upper Green Sand: Warminster and vale of Pewsey, Wiltshire.

RHOPALOSPONGIA OBLIQUA, *Hinde*, n. sp. (Plate XXII. figs. 3, 3 *a*.)

Sponge compound, consisting of two short individuals, inversely conical in form, growing from a single short, somewhat compressed stem. The summits are apparently oblique.

A transverse section exposes the canals, 1 mm. in width, which extend to the outer surface. These canals are more numerous and distinct than those of the last species.

The spicular structure of the interior resembles that in *R. gregaria.*

I have only met with a single example of this species: it is 85 mm. in height and 51 mm. in width.

Distribution. Upper Green Sand: Warminster, Wilts.

Order HEXACTINELLIDÆ, *Oscar Schmidt.*

Suborder DICTYONINA, *Zittel.*

Family *ASTYLOSPONGIDÆ.*

Genus ASTYLOSPONGIA, *Ferd. Rœmer*, 1860.

Ferd. Rœmer described the minute structure of *A. præmorsa*, the typical species of the genus, as consisting of very regular six-rayed, star-shaped bodies, which are connected together by the intermediate union of the rays of each body with the rays of those immediately adjoining ('Die silur. Faun. des west. Tenn.' p. 8). In a later definition of the genus ('Lethea Palæozoica,' 1 Th. p. 307) the same author states that the skeleton consists of a net-like web, composed of nodes, from which six rays extend at right angles with each other, and unite with the rays of the adjoining nodes. Prof. Zittel ('Studien,' 1 Th. p. 45) states, in his diagnosis of the genus, that the skeleton consists of amalgamated six-rayed spicules with solid nodes, forming an irregular net-work with triangular, quadrangular, or polyangular meshes, and that, as a rule, the arms of several adjoining spicules attach themselves to a single node. In 1878 Dr. K. Martin published a very important memoir on the structure of *Astylospongia* ('Archiv des Vereins der Freunde der Naturgeschichte in Mecklenburg'), in which he states that the number of the rays which radiate from a single node vary from six to nine in number, and that they radiate in most variable directions in order to unite with other rays to form a new node. He also made the interesting discovery that the terminations of the rays divide into minute branches (*loc. cit.* Taf. 1. f. 3). These facts led Dr. Martin to express the opinion that there were wide differences between *Astylospongia* and typical Hexactinellids. In a short comment on Dr. Martin's memoir, Prof. Zittel ('Neues Jahrbuch,' 1877, p. 709) states that the branching of the termination of the rays is entirely the result of the state of preservation of the specimen, and that in unaltered examples the nodes are always solid.

An examination of the microscopic structure of *Astylospongia præmorsa* from Tennessee leads me to confirm the observations of Martin that the spicules of this species are composed of solid nodes with from six to nine smooth arms which radiate from the centre in different directions and at varying angles. The terminations of the arms or rays of adjoining nodes unite together, and appear to form nodes by their union, which, when the specimen is unaltered, cannot be distinguished from the nodes from which the arms themselves originated; but in specimens where a certain amount of alteration has taken place, these secondary nodes can be seen to be composed of the expanded terminations of the arms of several spicules united together. If this view

is correct, *Astylospongia præmorsa* can hardly be regarded as a hexactinellid sponge, but shows a near relationship in its minute structure to the Lithistid genera *Cylindrophyma* and *Melonella*.

As, however, further observations are necessary to establish the true character of the spicular structure of *Astylospongia*, I prefer in the meantime not to remove the genus from the position assigned to it by Prof. Zittel.

Astylospongia præmorsa, *Goldfuss*, sp.

1833. *Siphonia præmorsa*, Goldf. Petref. 1 Th. p. 17, t. 6. f. 9.
1833. *Siphonia excavata*, Goldf. Petref. 1 Th. p. 17, t. 6. f. 8.
1860. *Astylospongia præmorsa*, F. Rœmer, Silur. Fauna d. west. Tenn. p. 8, t. 1. f. 1.
1877. *Astylospongia præmorsa*, Zitt. Studien, I Ab. p. 45; id. Neues Jahrbuch, p. 353, t. 2. f. 1; id. Handbuch der Pal. p. 172, f. 88.
1878. *Astylospongia præmorsa*, Martin, Archiv des Vereins d. F. d. N. Mecklenburg, p. 1, t. 1.
1878. *Siphonia præmorsa*, Quenst. Petref. Bd. 5, p. 551, t. 141. f. 1–3.

Distribution. Silurian (Niagara group): Waldron, Indiana; Bath Springs, Perry County, Tennessee.

Astylospongia stellatim-sulcata, *Rœmer*.

1848. *Spongia stellatim-sulcata*, F. Rœmer, Leonh. u. Bronn's Jahrbuch, p. 686, t. 9. f. 5.
1860. *Astylospongia stellatim-sulcata*, F. Rœmer, Silur. Fauna d. west. Tenn. p. 11, t. 1. f. 2, 2 *a*, 2 *b*.

Distribution. Silurian (Niagara group): West Tennessee.

Astylospongia inciso-lobata, *Rœmer*.

1848. *Spongia inciso-lobata*, F. Rœmer, Leonh. u. Bronn's Jahrb. p. 685.
1860. *Astylospongia inciso-lobata*, F. Rœmer, Silur. Fauna d. west. Tenn. p. 11, t. 1. f. 3, 3 *a*.

Distribution. Silurian (Niagara group): Bath Springs, Perry County, Tennessee.

Astylospongia imbricato-articulata, *Rœmer*.

1848. *Siphonia imbricato-articulata*, Rœmer, Leonh. u. Bronn's Jahrb. p. 685, t. 9. f. 3.
1860. *Astylospongia imbricato-articulata*, Rœmer, Silur. Fauna d. westl. Tenn. p. 12, t. 1. f. 5, 5 *a*.

Distribution. Silurian (Niagara group): West Tennessee.

Astylospongia? Rœmeri, *Hinde*, n. sp. (Plate XXIII. figs. 1, 1 *a*, 1 *b*.)

A fragmentary specimen, having the spicular structure of the genus, but the portion preserved is insufficient to determine the complete form and canal-structure. The fragment is of a conical form, with open sinuous channels 1·75 mm. wide

extending downwards from the summit of the cone. Circular canal-apertures, 1·25 mm. wide, are closely arranged in linear series in the channels, and also on the summit. The canals appear to extend in a nearly straight direction to the central portion of the sponge. The spicular nodes are about ·16 mm. in thickness, the arms about ·15 mm. in length and ·041 mm. in thickness. The minute expanded terminations at the ends of the arms are very clearly shown in microscopic sections of this form.

Nothing is known of the geological horizon or locality whence the specimen comes, but the condition of preservation is precisely similar to that of specimens of *Astylospongia* from the Silurian of North America.

Genus PALÆOMANON, *Rœmer*, 1860.

PALÆOMANON CRATERA, *Rœmer*.

1848. ***Siphonia cratera***, Rœmer, Leonh. u. Bronn's Jahrb. p. 685, t. 9. f. 4, 4 *a*.
1860. ***Palæomanon cratera***, Rœmer, Silur. Faun. d. west. Tenn. p. 13, t. 1. f. 4, 4 *a*.
1877. ***Palæomanon cratera***, Zitt. Studien, I Ab. p. 45.

Distribution. Silurian (Niagara group): West Tennessee.

Family *EURETIDÆ*, Zittel.

Genus TREMADICTYON, *Zittel*, 1877.

TREMADICTYON RETICULATUM, *Goldfuss*, sp.

1833. ***Scyphia reticulata***, Goldf. Petref. 1 Th. p. 11, t. 4. f. 1.
1833. ***Scyphia polyommata***, Goldf. Petref. 1 Th. p. 8, t. 2. f. 16.
1833. ***Scyphia fenestrata***, Goldf. Petref. 1 Th. p. 7, t. 2. f. 15.
1833. ***Scyphia pertusa***, Goldf. Petref. 1 Th. p. 6, t. 2. f. 8.
1877. ***Tremadictyon reticulatum***, Zitt. Studien, I Ab. p. 46; Neues Jahrbuch, p. 355, t. 2. f. 2, also p. 706; Handbuch d. Pal. p. 173, f. 89.
1878. ***Spongites reticulatus***, Quenst. Petref. Bd. 5, p. 28, t. 115. f. 1–12, 14–23.

Distribution. Upper Jura, Spongitenkalk: Heuberg, Randen, Nattheim, Streitberg.

TREMADICTYON OBLIQUATUM, *Quenst*. sp.

1858. ***Spongites obliquatus***, Quenst. Der Jura, p. 671, t. 81. f. 97.
1877. ***Tremadictyon obliquatum***, Zitt. Studien, I Ab. p. 46.

Distribution. Upper Jura: Heuberg, Randen, Würtemberg.

Genus CRATICULARIA, *Zittel*, 1877.

CRATICULARIA CLATHRATA, *Goldf.* sp.

1833. ***Scyphia clathrata***, Goldf. Petref. 1 Th. p. 8, t. 3. f. 1.
1877. ***Craticularia clathrata***, Zitt. Studien, I Ab. p. 46; Neues Jahrbuch, p. 355.
1878. ***Spongites clathrata***, Quenst. Petref. Bd. 5, p. 74, t. 117. f. 23, 25.

Distribution. Upper Jura: Heuberg, Randen, Würtemberg.

CRATICULARIA PARALLELA, *Goldf.* sp.

1833. ***Scyphia parallela***, Goldf. Petref. 1 Th. p. 8, t. 3. f. 3.
1877. ***Craticularia parallela***, Zitt. Studien, I Ab. p. 46; Neues Jahrbuch, p. 355.
1878. ***Spongites cylindritextus***, Quenst. Petref. Bd. 5, p. 65, t. 117. f. 9–15.

Distribution. Upper Jura: Heuberg, Wodna, Cracow (*Zittel's coll.*).

CRATICULARIA DECORATA, *Münster*, sp.

1833. ***Scyphia decorata***, Münster in Goldf. Petref. 1 Th. p. 90, t. 33. f. 2 *a*, *b*.

Distribution. Upper Jura: Randen.

CRATICULARIA PARADOXA, *Münster*, sp.

1833. ***Scyphia paradoxa***, Münster in Goldf. Petref. 1 Th. p. 86, t. 31. f. 6.
1877. ***Craticularia paradoxa***, Zitt. Studien, I Ab. p. 46; Neues Jahrbuch, p. 356; Handbuch d. Pal. p. 174, f. 90.
1878. ***Clathrispongia trochiformis***, ***ventricosa***, et ***perlata***, Quenst. Petref. Bd. 5, pp. 75, 76, 80, t. 118. f. 2, 3, 6.

Distribution. Upper Jura: Streitberg (*Zitt. coll.*), Randen, Würtemberg.

CRATICULARIA FITTONI, *Mantell*, sp. (Plate XXIII. figs. 2, 2 *a*, 2 *b*.)

1833. ***Millepora Fittoni***, Mantell, Geology S. E. of England, p. 378.
1822. ***Millepora*** ——, Mantell, Geol. of Sussex, p. 106, t. 15. f. 10.
1848. ***Brachiolites digitatus***, Toulmin Smith, Ann. Mag. Nat. Hist. vol. i. pp. 45, 365, t. 16. f. 2.
1854. ***Brachiolites Fittoni***, Morris, Cat. Brit. Foss. p. 26.
1864. ***Dendrospongia fenestralis***, F. A. Rœmer, Palæont. Bd. 13, p. 21, t. 8. f. 6.

Sponges growing in masses of straight or slightly sinuous cylindrical branches, from 22 mm. to 35 mm. in diameter and in some cases more than 220 mm. in length. The branches are hollow tubes with walls from 2·5 mm. to 4 mm. in thickness; the summits are open. The canal-apertures, both on the outer and inner wall-surfaces, are disposed in vertical and horizontal rows; the apertures are subquadrate at the surface, and from 1 mm. to 1·5 mm. in width.

In most of the examples the spicular structure has been completely replaced by

Genus SPORADOPYLE, *Zittel*, 1877.

SPORADOPYLE OBLIQUA, *Goldf.* sp.

1833. ***Scyphia obliqua***, Goldf. Petref. 1 Th. p. 9, t. 3. f. 5 *a*, *b*, *d*.
1877. ***Sporadopyle obliqua***, Zitt. Studien, I Ab. p. 47; Neues Jahrb. p. 356, t. 2. f. 6.
1878. ***Favispongia obliqua***, Quenst. Petref. Bd. 5, p. 118, t. 120. f. 29–53.

Distribution. Upper Jura: Randen, Streitberg, Bavaria.

SPORADOPYLE TEXTURATA, *Goldf.* sp.

1833. ***Scyphia texturata***, Goldf. Petref. 1 Th. p. 6, t. 2. f. 9.
1833. ***Scyphia pertusa***, Goldf. Petref. 1 Th. p. 6, t. 2. f. 8.
1877. ***Sporadopyle texturata***, Zitt. Studien, I Ab. p. 47; Neues Jahrbuch, p. 356.
1878. ***Scyphia pertusa***, Quenst. Petref. Bd. 5, pp. 126–129, t. 120. f. 61–69.

Distribution. Upper Jura: Randen, Würtemberg.

SPORADOPYLE RAMOSA, *Quenst.* sp.

1858. ***Spongites ramosus***, Quenst. Der Jura, p. 683, t. 83. f. 1.
1877. ***Sporadopyle ramosa***, Zitt. Studien, I Ab. p. 47; Neues Jahrb. p. 356.
1878. ***Ramispongia ramosa***, Quenst. Petref. p. 140, t. 121. f. 11.

Distribution. Upper Jura: Heuberg, Randen.

SPORADOPYLE, sp.

Distribution. Upper Jura: Heuberg, Wodna, Cracow (*Zittel's coll.*).

Genus STREPHINIA, *Hinde*, n. g.

Sponges growing in irregular, convolute, anastomosing expansions or open cup-shaped. The wall on both sides is irregularly reticulate with circular, oval, or irregular canal apertures of relatively large size. The canals terminate blindly. The spicular mesh is small and somewhat irregular, the spicular arms apparently smooth; the nodes are solid. No special dermal layer is present.

In the mode of growth this genus differs from any other of this family. The characters of the spicular mesh resemble those of *Sphenaulax* and *Sporadopyle*. The only examples are from the Grey Chalk, and their skeletons have been completely replaced by crystalline calcite.

STREPHINIA CONVOLUTA, *Hinde*, n. sp. (Plate XXIII. figs. 3, 3 *a*, 3 *b*.)

The walls of the sponge are convolute and anastomose so as to form irregular masses. The wall is 4 mm. in thickness; the outer surface is reticulate, with closely set, circular or oval canal-apertures, from 1 to 1·5 mm. in width, and about 1·3 mm.

small, upward projecting, cylindrical or compressed tubes, which are open above. Neither the summit nor basal portion is preserved in the specimens. The example figured by Smith is 61 mm. in height and 30 mm. in width. Another imperfect specimen in the Museum is 86 mm. in height and 61 mm. in width. The projecting tubes are from 3 mm. to 7·6 mm. in diameter, and in length from mere projecting cups to tubes 17·6 mm. in length. The thickness of the spicular wall is about 1·2 mm. The outer surface of the wall has a delicate lace-like dermal layer composed of somewhat thickened spicular arms and nodes. There are minute circular apertures, about ·5 mm. in width, in this layer as well as the small interspaces in the mesh itself. The mesh-spicules are small, with solid nodes. I have not been able to determine the characters of the inner surface of the wall.

From the typical Jurassic forms of *Verrucocœlia* this species differs in the possession of a modified dermal layer; but I do not regard this feature as of sufficient importance to place this form in a new genus, but propose to extend Zittel's definition so as to include sponges with a perforate dermal layer. The spicules of the interior mesh of the wall, and the general mode of growth, resemble the typical Jurassic species.

The specimens are now in the condition of iron peroxide. The figure of this species given by T. Smith represents it in a reverse position. The woodcut (fig. Q) on p. 367, in the 'Annals,' which, according to Smith, represents a transverse section of this species near the top, does not appear to belong to this form at all.

Distribution. Upper Chalk: South of England.

VERRUCOCŒLIA VECTENSIS, *Hinde*, n. sp. (Plate XXIV. figs. 3, 3 *a*, 3 *b*.)

Sponge generally conical in form, widest a short distance above the base, and thence tapering to the summit. The only specimen is 152 mm. in height and 100 mm. in greatest width. Numerous cylindrical tubes, from 20 to 35 mm. in length and from 11 to 20 mm. in width, spring from the central cavity and project upwards. These tubes are open at the surface; the margins are rounded. The walls are from 2 to 2·5 mm. in thickness, and the interior of the tubes from 5 to 13 mm. in width. The spicular structure of the outer surface-layer is slightly different from that of the interior of the wall in that the arms and nodes of the spicules are somewhat thicker. This reticulate dermal layer is perforated by numerous circular or ovate canal-apertures, about ·5 mm. in width. The spicular mesh of the interior of the wall is somewhat irregular, and is composed of robust spicules with compact (*i. e.* not lantern) nodes. The spicular arms are in places minutely spinous, in other places they appear to be smooth; they vary from ·045 to ·067 mm. in thickness, and the distance from one nodal centre to another is about ·225 mm. There are also occasionally present in the interstices of the mesh very minute delicate hexactinellid spicules, which are only attached by the extremity of a single arm to the mesh itself.

The large dimensions of this species, and the size of the tubes and walls, readily distinguish it from all others of the genus. The only specimen is in Chalk Marl, and the spicular structure comes out very perfectly when the matrix is removed by acid.

Distribution. Chalk Marl: Ventnor, Isle of Wight (*Mantell's coll.*).

Genus STAURONEMA, *Sollas*, 1877.

STAURONEMA CARTERI, *Sollas*. (Plate XXIV. figs. 1, 1 *a*, 1 *b*.)

1877. *Stauronema Carteri,* Sollas, Ann. & Mag. Nat. Hist. vol. xix. p. 1, t. 1–5.
1877. *Stauronema Carteri,* Zitt. Studien, I Ab. p. 62; Neues Jahrbuch, p. 359.

Examples of this species in the Museum collection from the Chalk Marl of Barham and the Isle of Wight, and from the Craie Chloritée of Cap la Hève, show the minute spicular structures in a much clearer manner than the specimens from the Upper Green Sand of Folkestone, on which Prof. Sollas based his descriptions; and they enable me to add to, and partly to emend, the characters which he has assigned to the species and genus.

The canals which pass into the true wall (oscular plate, *Sollas*) from the inner or concave surface of the sponge, do not appear to penetrate through it, as stated by Sollas, but terminate blindly near the outer surface of the sponge, and, similarly, the canals which enter the wall from the outer surface end blindly in the substance of the wall. The canals in the supplemental skeleton (posterior mass) are altogether irregular in their distribution. The spicular mesh of the true wall is by no means so regular in its disposition throughout as represented by Sollas in figs. 1–3, p. 7, *loc. cit.*, for though the mesh-interspaces are often circular, yet they are as often quadrate, oval, or irregular in form.

Again, Sollas states (p. 7) that "the outer margins of the fibres are so sharply defined as to enable us to state with certainty that the fibres themselves are perfectly smooth, and not in any way spined." But in the example from La Hève, not only are the surfaces of the spicules bordering the canals thickly spined, which Sollas observed in the Folkestone examples, but the spicular arms throughout the wall and in the supplemental skeleton are clearly microspined. A remarkable feature in this species is the supplemental skeleton (posterior mass, *Sollas*), which is composed of a spicular mesh, with arms or rays of about the same thickness as in the true wall, but disposed in such a manner that the interspaces are extremely irregular, both in size and form. This tissue appears to be of a similar character to that which in some fossil sponges forms the stem and radical processes, and also grows over the lower portion of the true sponge-wall. It is shown more particularly in the genus *Pleurope*, Zittel, and is well developed in *Craticularia* (*Laocœtis*) *infundibulata* *, Pomel. The

* Pal. d'Oran. 1866, p. 95, t. 1 bis, fig. 4.

dermal layer, which is formed of an extremely minute and delicate spicular reticulation, extends alike over this supplemental skeleton as well as over the front surface of the true wall.

The characters of *Stauronema* appear to me to exhibit a closer alliance to the family of the Euretidæ than to the family of the Mellitionidæ, in which Prof. Zittel*, relying upon the descriptions of Prof. Sollas, has placed the genus.

Prof. Sollas states that his specimens came from the Gault of Folkestone; but the numerous specimens in the Museum collection from the same locality, are, according to the opinion of Mr. R. Etheridge, sen., all derived from the Upper Green Sand†, and as Sollas's specimens were supplied to him by a local dealer, and were not collected by himself, it seems probable that they also may have been obtained from the Upper Green Sand, and not from the Gault.

Distribution. Upper Green Sand: Folkestone; near Eastbourne. Chalk Marl: near Ventnor, Isle of Wight; Barham. Craie Chloritée: Cap la Hève.

STAURONEMA PLANUM, *Hinde*, n. sp. (Plate XXIV. figs. 2, 2 *a*, 2 *b*, 2 *c*.)

Sponge disk-shaped, with a circular outline; the upper surface nearly flat, the under surface slightly convex, with concentric rounded ridges and furrows. There is no indication of a stem or point of attachment. The margins are rounded and slightly curve downwards. The width of the only specimen at present known is 70 mm. In the central portion the wall-plate is 12·5 mm. in thickness and near the margin 6·3 mm.

The upper surface of the sponge is reticulate, with circular or ovate canal-apertures about 1 mm. in diameter and about 1·3 mm. apart from each other. The canals are slightly curved and appear to terminate blindly. No special canals are distinguishable on the under surface of the sponge.

The sponge-wall is composed of a regular meshwork of robust spicules with solid nodes; the distance between the nodes is ·35 mm. The interspaces between the mesh are subquadrate or nearly circular. The upper surface exhibits traces of a finely reticulate dermal layer, which apparently extended over the canal-apertures. The under surface also shows a delicate dermal layer of reticulate spicules, but its state of preservation is insufficient for a close determination.

This species differs from *S. Carteri*, Sollas, in its form and in the absence of a supplemental skeleton; but it resembles that species in the character of the spicular skeleton of the wall and the disposition of the canals.

The non-development in this species of the supplemental skeleton or posterior

* Neues Jahrbuch, 1877, p. 359.

† Mr. F. G. H. Price also quotes this species from the Upper Green Sand or lower division of his Chalk Marl at Folkestone, and he names this division the *Stauronema*-zone. No mention is made of its occurrence in the Gault. (Quart. Journ. Geol. Soc. 1877, vol. xxxiii. p. 434.)

mass, which is such a prominent feature in the type of the genus, does not appear to me to be of sufficient importance by itself to justify placing this form in a separate genus, and it would be preferable to extend the definition of *Stauronema* so as to include sponges in which a supplemental skeleton is not present.

The only example of this species has the spicular structure replaced by calcite, and by a dark material, probably iron peroxide. This dark substance has infilled the canals of the hexactinellid spicules, which are thus distinctly shown, even when the spicular arms themselves have been obliterated.

Distribution. Grey Chalk: Folkestone.

STAURONEMA COMPACTUM, *Hinde*, n. sp. (Plate XXV. figs. 1, 1*a*, 1*b*, 1*c*, 1*d*.)

Sponge apparently forming an ear- or fan-shaped expansion, growing from a small rounded basal process; the wall is between 6·8 and 8 mm. in thickness. The only specimen is the lower portion of an example, and measures 43 by 25 mm.

Both surfaces of the sponge-wall are furnished with oval canal-apertures from ·75 to 1 mm. in diameter, arranged in decussating lines. On what appears to be the inner or upper surface these canal-apertures are about 2 lines apart, and the interspaces between them consist of a thickened reticulate mesh with definite circular pores. On the opposite surface the canal-openings are completely covered in the lower part of the wall by a dermal layer of thickened irregular spicular tissue; somewhat higher the canals are only bridged over by this tissue, but not concealed. The canals are blind, and follow a slightly curved direction through the wall.

The spicular mesh of the interior of the wall is composed of robust spicules with compact nodes; the arms are apparently smooth; the distance between the nodal centres is ·33 mm. The interspaces of the mesh are circular or oval.

Quenstedt* has figured a sponge from the Lower Pläner of Bohemia, under the name of *Scyphia tenuis*, which in the characters of the dermal layer and the canal-structure closely resembles the present species; but according to Quenstedt its spicular nodes are partly octahedral and partly solid, whereas in the present form the spicular nodes are compact throughout.

Distribution. Grès vert (Upper Green Sand): France?

Genus SESTRODICTYON, *Hinde*, n. g.

Sponge funnel-shaped, apparently by the infolding and coalescence of a plate-like wall. The wall is perforated by numerous canals, arranged in a generally linear direction, and occasionally decussating. The skeletal mesh is composed of robust spicules with compact nodes, which form a very regular quadrate mesh with small circular interspaces. No dermal layer appears to be present.

* Petrof. Bd. 5, p. 457, t. 137. f. 4.

This genus resembles *Stauronema* in the robust character of its spicular mesh, but differs therefrom in the absence of a dermal layer and the perforate character of the canals. The only specimen exhibits the spicular structure and the outer surface very perfectly, but the interior is infilled, and quite concealed by the matrix.

SESTRODICTYON CONVOLUTUM, *Hinde*, n. sp. (Plate XXV. figs. 2, 2 *a.*)

The funnel-shaped sponge, which is imperfect at the base, measures 68 mm. in height and 84 mm. in width at the summit. The canals are ovate in form, about 1·75 mm. in their greatest diameter; the distance between the rows is about 1·3 mm. The spicules of the mesh have smooth arms; the distance between the nodal centres is ·3 mm. Small pointed spines, apparently the free arms of the spicules bordering the canals, project from the walls into the canals.

The outer surface characters of the specimen are so perfectly preserved, that if any dermal layer had existed, one can hardly doubt but that traces of it would have remained.

Distribution. Alpine Chalk (= Upper Green Sand): High Sentis, Canton Appenzell.

Genus BRACHIOSPONGIA, *Marsh*, 1867.

BRACHIOSPONGIA DIGITATA, *D. Owen*, sp.

1857. *Scyphia digitata,* D. Owen, Second Report on the Geol. of Kentucky, p. 111.

1838. *Description d'un fossile,* Troost. Mém. de la Soc. Géol. de France, Tome 3, t. 11. f. 8, 9, 10.

1867. *Brachiospongia Rœmerana* et *Lyonii,* Marsh, Am. Journ. Science and Arts, 2 ser. vol. 44, p. 88.

1878. *Brachiospongia,* Zitt. Handb. der Pal. Bd. 1, p. 173.

1880. *Brachiospongia Rœmerana,* F. Rœmer, Leth. geog. 1 Th. p. 319, fig. 61.

Up to the present nothing definite is known of the spicular structure of this extraordinary sponge, and its true characters and position are therefore uncertain. By Prof. Zittel it has been provisionally placed in the family of the Euretidæ. The Museum only possesses a cast.

Distribution. Cincinnati Group: Kentucky.

Family *COSCINOPORIDÆ.*

Genus LEPTOPHRAGMA, *Zittel*, 1877.

LEPTOPHRAGMA MURCHISONI, *Goldf.*, sp.

1826–1833. *Scyphia Murchisoni,* Goldf. Petref. 1 Th. p. 219, t. 65. f. 8.

1877. *Leptophragma Murchisoni,* Zitt. Studien, I Ab. p. 48; Neues Jahrbuch, p. 357, t. 3. f. 1.

Cup- or funnel-shaped sponges, with walls from 1·5 to 2 mm. in thickness. Variable in size; an average specimen measures 100 mm. in height and 75 in width at the summit.

The canal-apertures of the outer surface are circular and very regularly disposed in vertical and horizontal rows; they are about ·5 mm. in width, and about the same distance apart.

The spicular mesh has been replaced by peroxide of iron or dissolved away, and is very indistinctly shown.

Distribution. Upper Green Sand (?): near Folkestone. Lower Chalk: South of England. Upper Chalk: Haldem, Germany.

Leptophragma fragilis, *Rœmer*, sp.

1840. *Scyphia fragilis,* F. A. Rœmer, Nordd. Kreide, p. 8, t. 3. f. 11.
1877. *Leptophragma fragilis,* Zitt. Studien, I Ab. p. 48; Neues Jahrbuch, p. 358.

Sponge in the form of a shallow, open cup supported on an elongated cylindrical stem. One specimen, imperfect at the margins, is 90 mm. in width; in another specimen a stem 80 mm. in length and 65 in width, supports a portion of a cup.

The walls are only ·5 mm. in thickness; their surfaces are closely covered with minute canal-apertures ·25 mm. wide, disposed in rows, or irregular in their distribution. The mesh of the cup-wall has been changed into iron peroxide, and is not recognizable. The spicules of the stem are elongate and irregular in form.

Distribution. Upper Chalk: South of England (*coll. Bowerbank* and *Toul. Smith*).

Genus PLEUROSTOMA, *Rœm.* 1840, emend. *Zitt.* 1877.

Pleurostoma radiatum, *Rœmer*.

1840. *Pleurostoma radiatum,* Rœmer, Nordd. Kreide, p. 5, t. 1. f. 11.
1877. *Pleurostoma radiatum,* Zitt. Studien, I Ab. p. 48; Neues Jahrbuch, p. 358.

The only specimen in the collection referable to this species is an elongated, geniculate, much compressed stem 100 mm. in length, 14 mm. in width, and 3·5 mm. in thickness. At the basal end are several lateral root-like processes; the summit is imperfect. The walls of this hollow stem are about ·75 mm. in thickness. On both the lateral edges of the stem there are at irregular intervals circular or ovate apertures from 2 to 3 mm. in width, which open into the central hollow. The outer surface of the wall is provided with numerous closely set circular apertures ·35 mm. in width, and about the same distance apart, and without definite arrangement. The spicular mesh has been replaced by iron peroxide.

Distribution. Upper Chalk: South of England (*coll. T. Smith*).

PLEUROSTOMA BOHEMICUM, *Zittel.*

1877. *Pleurostoma bohemicum,* Zitt. Studien, I Ab. p. 48; Neues Jahrbuch, p. 358.

Distribution. Upper Chalk: Plauen, Bohemia (*coll. Zittel*).

Genus GUETTARDIA, *Michelin,* 1840–47.

GUETTARDIA STELLATA, *Michelin* (pars).

1840–47. *Guettardia stellata,* Michelin, Icon. Zooph. p. 121, t. 30. f. 3, 4, 6, 8–11, cet. excl.

1846. *Guettardia Thiolati,* D'Archiac, Mém. Soc. Géol. 2 sér. p. 197, t. 5. f. 15, and t. 8. f. 5, 6, 7.

1848. *Brachiolites angularis,* T. Smith, Ann. & Mag. Nat. Hist. vol. i. p. 357, f. O & P.

The number of the radiating flanges in this well-known sponge varies in different examples from 3 to 10, the parallel walls are from 1 to 2 mm. in thickness, and about the same distance apart. The apertures on the outer lateral edges of the flanges are ovate, and from 3 to 4 mm. in width. The base is usually rounded or with an imperfect stem; slender radical processes also appear to have originally extended from the lateral edges of the flanges so as to serve in keeping the sponge in an upright position. The central space appears to have been open above, and there also appears to have been entirely free communication between the flanges and the centre. There is great diversity in the size of different examples; a small form is 28 mm. in height by 30 mm. in width, and some of the large examples, judging by the extension of a single flange, must have been 240 mm. in width by 100 mm. in height.

The walls carry thickly-set, minute, circular or oval canal-apertures, about ·5 mm. in width, disposed generally in quincunx. The spicules of the interior wall form an irregular mesh with solid nodes. The dermal layer on the exterior surface, between the canal-apertures, differs from the spicular mesh of the interior in a greater thickness of the spicular arms, so that only minute circular pores remain between them.

The most complete description of this species is that given by Toulmin Smith from the examples in the English Chalk, which are either in the condition of rusty peroxide of iron in the chalk itself, or preserved as reddish markings in flint. The figure given by T. Smith, *loc. cit.* p. 358, fig. O, is, to a certain extent, diagrammatic, for the original in the Museum collection is by no means so complete as represented.

Michelin appears to me to have figured more than one species under *G. stellata* in pl. 30, *l. c.* Thus in the figures 2 and 5 the flanges grow upwards, and form separate flattened branches, the same as in *Pleurostoma*, and only communicate with the central cavity near their bases, and in this respect differ from the examples which he has placed under figs. 3, 4, 6, 8, 9. For these latter forms I propose to retain the name of *G. stellata.* D'Archiac has claimed one of these (fig. 6) as belonging to his species *G. Thiolati*, but he might equally well have claimed the other examples

(figs. 3, 4, 8, 9), as they clearly belong to the same species. The Museum possesses several specimens from Biarritz which correspond very closely with D'Archiac's figures of *G. Thiolati* from that locality; and I am unable to find any satisfactory differences to distinguish them from the Chalk specimens of *G. stellata*, beyond those which may arise from difference of preservation. As a rule, however, they are smaller than the Chalk forms.

The example figured by Mantell under the name of *Ventriculites quadrangularis**, is stated by T. Smith to be a fragment of this species; but neither Mantell's figure nor description is sufficiently clear for satisfactory recognition.

Distribution. Grey Chalk: Dover. Lower and Upper Chalk: Boxley, Kent; Croydon, Shalford, Surrey; Glynde, Sussex; South of England (*coll. T. Smith*). Cretaceous: Biarritz (*coll. Pratt*).

GUETTARDIA RADIANS, *Hinde*, n. sp. (Plate XXV. fig. 3.)

1840–47. *Guettardia stellata*, Michelin, pars, Icon. Zooph. pl. 30. f. 1, 2, 5.

Sponge consisting of a varying number, from 3 to 5 generally, of compressed branches, which spring from a common, slightly inflated, hollow base, supported on a short stem. The branches are from 14 to 24 mm. in width; the parallel walls are about 2 mm. in thickness, and about the same distance apart; circular apertures are present on both the lateral margins. The wall-surface appears to be covered with minute canal-apertures similar to those in *G. stellata.* No spicular structure is present in the specimens.

I propose this species to include some of the forms included by Michelin under *G. stellata*, but which differ from those to which I have restricted this term in the fact that instead of forming flanges which open throughout their length into a central cavity, the sponge divides into compressed branches, thus resembling a compound *Pleurostoma.*

Distribution. Craie Chloritée: Vaches Noires. Biarritz? (*coll. Pratt*).

Genus COSCINOPORA, *Goldfuss*, 1826–33.

COSCINOPORA INFUNDIBULIFORMIS, *Goldf.*

1826–33. *Coscinopora infundibuliformis*, Goldf. Petref. 1 Th. p. 30, t. 30. f. 10.

1877. *Coscinopora infundibuliformis*, Zitt. Studien, I Ab. p. 49; Neues Jahrbuch, p. 359, t. 2. f. 4.

1878. *Coscinopora infundibuliformis*, Zitt. Handb. der Pal. p. 175, f. 91.

There are several examples from the Upper Chalk of the south of England which correspond in form and in the arrangement of the canal-apertures with typical

* Geology of Sussex, p. 177, t. 15. f. 6.

specimens from Germany; but as their spicular structure has been obliterated, a satisfactory identification is impracticable.

Distribution. Upper Chalk: Croydon, Surrey; South of England; Coesfeld, Dahlfeld, Westphalia.

COSCINOPORA QUINCUNCIALIS, *Toulmin Smith*, sp.

1847–48. *Ventriculites quincuncialis*, T. Smith, Ann. & Mag. Nat. Hist. 1 ser. vol. xx. t. 7. f. 7, and 2 ser. vol. i. p. 207.

Sponges narrow funnel-shaped, gradually tapering to a cylindrical stem, which gives off horizontal root-like processes at its termination. An average specimen is 70 mm. in height, and 25 mm. in width at the summit.

The walls are from 2 to 2·5 mm. in thickness; the canal-apertures on the outer surface are about ·5 mm. in diameter, and disposed in very regular quincunx. Here and there, in some specimens, traces of spicules can be detected; they appear to have had compact nodes. The spicular structure of the stem is formed of elongated irregular spicules; this structure overlaps the regular mesh-work of the wall in the lower part of the body of the sponge.

This species is readily distinguished from *C. infundibuliformis* by its narrow elongated form and the smaller size of the canals. Toulmin Smith states that the walls of this species are folded the same as in *Ventriculites*, but I am unable to recognize this character in his typical figured specimen. The specimens are preserved in flint, and all appear to be incomplete at the summit.

Distribution. Upper Chalk: Croydon, Surrey; Arundel, Sussex; Beckhampton, Wiltshire.

Family *MELLITIONIDÆ*, Zittel.

Genus APHROCALLISTES, *Gray*, 1858.

APHROCALLISTES ALVEOLITES, *Rœmer*, sp.

1840. *Scyphia alveolites*, Rœmer, sp., Nordd. Kreide, p. 8, t. 3. f. 6.

1877. *Aphrocallistes alveolites*, Zittel, Studien, I Ab. p. 49; Neues Jahrbuch, p. 359.

The specimens which I refer to this species consist of two small fragments of the sponge-wall, which is composed of prismatic canals 1·75 mm. in diameter, with very delicate partitions. The spicular structure is now in the condition of iron peroxide; and as the character of the mesh cannot be distinguished, there is some doubt as to the correct identification of the specimens.

Distribution. Upper Chalk: South of England?

Family *VENTRICULITIDÆ.*

Genus PACHYTEICHISMA, *Zittel*, 1877.

PACHYTEICHISMA CARTERI, *Zittel.*

1877. *Pachyteichisma Carteri*, Zittel, Studien, I Ab. p. 50; Neues Jahrbuch, p. 360, t. 3. f. 3; id. 1878, p. 59; Handbuch der Pal. p. 176, f. 92.
1808. *An Alcyonite*, Parkinson, Organic Remains, vol. 2, t. 11. f. 2.
1820. *Spongus coarctatus*? König, Icones fossiles, p. 4, t. 7. f. 81.
1878. *Lancispongia lamellosa tumulosa*, Quenst. Petref. Bd. 5, p. 92, t. 119. f. 1.

Distribution. Upper Jura: Randen, Heuberg, Streitberg.

PACHYTEICHISMA LOPAS, *Quenst.* sp.

1858. *Spongites lopas*, Quenst. Der Jura, p. 685, t. 83. f. 5.
1877. *Pachyteichisma lopas*, Zitt. Studien, I Ab. p. 50; Neues Jahrbuch, p. 360.
1878. *Lancispongia lopas*, Quenst. Petref. Bd. 5, p. 95, t. 119. f. 3.

Distribution. Upper Jura: Heuberg, Würtemberg.

PACHYTEICHISMA, sp.

Portions of the spicular structure of an undetermined species from the Jurassic formation at Hohenpölz, Bavaria (*coll. Zittel*).

Genus TROCHOBOLUS, *Zittel*, 1877.

TROCHOBOLUS CRASSICOSTUS, *Zitt.*

1877. *Trochobolus crassicostus*, Zitt. Studien, I Ab. p. 50; Neues Jahrbuch, p. 360, t. 3. f. 4; idem, 1878, p. 60.
1878. *Scyphia barbata*, Quenst. Petref. Bd. 5, p. 124, t. 120. f. 54.

Distribution. Upper Jura: Randen, Streitberg (*coll. Zitt.*).

TROCHOBOLUS LUCERNUS, *König*, sp.

1820. *Spongus lucerna*, König, Icones fossiles, p. 4, t. 7. f. 83.
1820. *Spongus tuber*, König, Icon. foss. p. 4, t. 7. f. 84.
1878. *Mastospongia*, sp., Quenst. Petref. Bd. 5, p. 148, t. 122. f. 7.
1878. *Trochobolus*, Zitt. Neues Jahrbuch, p. 61.

I am doubtful whether this peculiar sponge is rightly included in the genus *Trochobolus*, for though it agrees with the type of the genus in its mode of growth, I am unable to determine whether the spicular nodes are compact or lantern-like. The spicular structure in all the specimens is replaced by either calcite or iron peroxide, and in sections of calcite specimens the spicular nodes appear to be compact; but it is doubtful whether the octahedral nodes can be detected in all

the cases in which replacement by calcite has occurred, though, as a rule, they are pretty clearly shown. Should further research prove that the nodes are compact, this species will have to be formed into a new genus, which will find its place close to *Verrucocœlia*.

Distribution. Upper Jura: Randen, Switzerland.

TROCHOBOLUS CONSTRICTUS, *Hinde*, n. sp. (Plate XXV. figs. 4, 4 *a*, 4 *b*.)

Sponge subcylindrical, surface uneven, with slight concentric swellings and depressions, the summit truncate with rounded margins. Length of the only specimen 87 mm., width at summit 29 mm.

The thickness of the sponge-wall, measuring from the interior of the cloaca to the outer surface, is 5 mm. The outer surface exhibits a vertical series of ridges about 2 mm. in width and 1 mm. apart. The characters of the interior of the cloaca are concealed by the matrix. The wall is built up of a regular spicular mesh with lantern or octahedral nodes. The distance between the nodal centres is ·312 mm.

The general appearance of this sponge so closely resembles the cylindrical examples of *Sphenaulax* (*Scyphia*) *costata*, Goldf., that, judging from this character merely, it would at once have been placed under this species; but in a longitudinal section of the wall the spicules exhibit distinct lantern nodes, and are similar to, though somewhat larger than, those of *T. crassicostus*.

Distribution. Upper Jura: Randen, Switzerland.

Genus PHLYCTÆNIUM, *Zittel*.

PHLYCTÆNIUM CONIFORMIS, *Quenst.* sp.

1878. ***Mastospongia coniformis***, Quenst. Petref. Bd. 5, p. 152, t. 122. f. 13.
1826–33. ***Scyphia verrucosa***, Goldf. p. p. Petref. 1 Th. p. 7, t. 2. f. 11.
1878. ***Phlyctænium coniformis***, Zitt. Neues Jahrbuch, p. 61.

Distribution. Upper Jura: Heuberg, Würtemberg.

Genus VENTRICULITES, *Mantell*, 1822.

VENTRICULITES RADIATUS, *Mantell*, pars.

1822. ***Ventriculites radiatus***, Mantell, Foss. of the South Downs, p. 168, t. 10, 11, 12, 14, non t. 13. f. 2–6.
1815. ***Alcyonium chonoides***, Mantell, Trans. Linn. Soc. vol. ii. p. 402. t. 27–30.
1845–46. ***Scyphia radiata***, Reuss, Ver. böh. Kreide, p. 74, t. 17. f. 14.
1854. ***Ventriculites radiatus***, Mantell, Medals of Creation, 2 ed. p. 244, f. 81.
1870. ***Retispongia radiata***, Ferd. Rœmer, pars, Geol. Oberschles. p. 302, t. 32, non t. 30. f. 5.
1878. ***Ventriculites radiatus discus***, Quenst. pars, Petref. Bd. 5, p. 449, t. 136. f. 26.

Sponge consisting of a circular, flattened, or slightly concave, or occasionally convex expansion, supported on a small funnel-shaped or inverted conical base, from the extremity of which divergent root-like processes extend, which served to anchor the sponge in the chalky mud.

The conical basal portion is from 20 to 30 mm. in height; the summit expansion attains, in fairly large examples, a diameter of 220 mm.

The *under* surface of the sponge exhibits a series of straight or slightly curved, occasionally bifurcating ridges, which radiate from the centre to the margins. These ridges are formed by the infolding of the thin wall-plaits of the sponge; they are connected together at intervals by transverse extensions. They are from 1·5 mm. to 2·5 mm. in thickness, and the intervening furrows are about 1 mm. in width.

The *upper* surface of the sponge has a smooth aspect; it is composed of a reticulated membrane with numerous circular or elliptical canal-apertures, from 1·5 to 3 mm. in width, disposed either irregularly or in quincunx. The total thickness of the sponge-wall varies according to the amount of compression it has experienced; in some examples in the Chalk it is only 2 to 3 mm., whilst in a flint-preserved example it reaches a thickness of 6·5 mm.

In only a single specimen out of a large number of examples of this species have I been enabled to discover traces of the spicular structure. The spicular mesh in this specimen appears to be extremely regular; the interspaces are nearly quadrate, and the distance between the spicular nodes is about ·4 mm.

This species is probably the most abundant of any of the *Ventriculites* in the English Chalk. It occurs either as mere impressions or as moulds filled with soft ochraceous material in the chalk, or else as casts in flint. Very frequently the basal or conical portion of a specimen is preserved in flint, whilst the expanded portion remains as a mere impression in the soft chalk. Its appearance varies greatly according to its mode of preservation, and the surface which is exposed to view.

I have taken as the type of the species the specimens figured by Mantell on tab. 14, 'Fossils of the South Downs.' The figures, though roughly drawn, exhibit very fairly both the upper and under surfaces of the sponge. The examples figured by Mantell on tab. 13 belong, with one doubtful exception, to other species of *Ventriculites*, and were so regarded by Mantell himself in the 'Medals of Creation,' p. 245, f. 82.

Distribution. Upper Chalk: Norfolk; Surrey; Sussex; near Warminster, Wiltshire (*coll. T. Smith* and *Mantell*).

VENTRICULITES IMPRESSUS, *Toulm. Smith.*

1848. ***Ventriculites impressus*, T. Smith, Ann. & Mag. Nat. Hist. 2nd ser. vol. i. p. 205; and 1st ser. vol. xx. t. 8. f. 2, 3.**

1848. *Ventriculites muricatus,* T. Smith, Ann. & Mag. Nat. Hist. vol. i. p. 210, t. 13. f. 1.
1878. *Ventriculites dilatatus,* Quenst. Petref. Bd. 5, p. 460, t. 137. f. 6.

Sponge usually open funnel-shaped, gradually tapering to a slender stem with divergent rootlets. In some instances the sponge forms flattened expansions with a circular outline similar to *V. radiatus.* Height and width very variable; a large specimen is 170 mm. in diameter.

The outer or under surface of the sponge-wall is reticulate, with circular or ovate apertures, from ·75 to 1·5 mm. in width; the wall-fibres bounding the apertures are about the same width as the interspaces. The upper or inner surface has numerous apertures of a similar form to those of the lower, and disposed either irregularly or in quincunx.

The total thickness of the wall is about 3 mm.; but as all the specimens are in chalk, and therefore compressed, it is impossible to determine the original thickness with accuracy. No spicular structure is shown in any of the specimens.

This species appears to be nearly as abundant as the preceding. There is a great amount of variation in different specimens, but I cannot find any characters which would allow of a separation into distinct species. The *V. muricatus,* T. Smith, appears to me, from a comparision of the original example in the Museum Collection, to belong to this species.

Distribution. Upper Chalk: South of England, Heytesbury; near Warminster, Wiltshire (*coll. T. Smith*).

VENTRICULITES CONVOLUTUS, *Hinde,* n. sp. (Plate XXV. figs. 5, 5 *a.*)

Sponges cup- or vase-shaped, with expanded margins and folded walls. No stem preserved, and the species appears to have been sessile. The wall of a specimen preserved in chalk is 1·6 mm. in thickness. A fairly large specimen is 60 mm. in height, and 120 mm. in breadth at the summit.

The outer surface is formed of flattened, bifurcating ridges about 1·5 mm. in width, which run nearly parallel with each other from the base to the margins, and inter-osculate so as to leave narrow, elongated interspaces. The interior of the wall is not exposed.

The spicular mesh, judging by the hollow casts in the Chalk, is irregular; the distance between the spicular nodes is about ·3 mm. This species may be distinguished by its folded thin walls and the disposition of the flattened ridges of the outer surface.

In outer form and the disposition of the ridges of the outer surface of the wall, this species resembles *Cribrospongia subreticulata,* Geinitz*; but the surface-apertures

* Palæontographica, Bd. 20, p. 23, t. 2. f. 2–4.

in this latter species have a rectangular arrangement, and the wall is three times as thick as in *V. convolutus.*

This species appears to be not uncommon in the Kentish Chalk.

Distribution. Upper Chalk: Gravesend, Broadstairs, Kent.

VENTRICULITES POCULUM, *Zittel*, MS.

Distribution. Upper Chalk: Libyan Desert (*Zitt. coll.*).

VENTRICULITES DECURRENS, *Toulm. Smith.*

1848. ***Ventriculites decurrens,*** T. Smith, Ann. & Mag. Nat. Hist. 2nd ser. vol. i. p. 215, t. 13. f. 8.

1848. ***Ventriculites decurrens,*** var. ***tenuiplicatus,*** T. Smith, ibid. p. 215, t. 13. f. 9.

1848. ***Ventriculites cavatus,*** T. Smith, ibid. p. 212, t. 13. f. 5.

1822. ***Ventriculites radiatus,*** Mantell, pars, Foss. South Downs, t. 13. f. 4.

1878. ***Ventriculites radiatus,*** Quenst. pars, Petref. Bd. 5, t. 136. f. 23.

Sponges varying in form, from subcylindrical to open funnel-shaped, gradually tapering below to a slender cylindrical stem with branching roots. Small examples measure 65 mm. in length by 23 in diameter, whilst a large specimen, without the slender stem, is 120 mm. in height and of an equal width at the summit.

The outer surface of the sponge is formed by robust vertical or oblique ridges, which occasionally bifurcate, but are rarely connected by lateral extensions. These ridges are 2 mm. in thickness, and the intervening furrows about ·75 mm. in width. The interior surface exhibits circular apertures. The entire thickness of the sponge-wall is 5 mm. The dermal layer of the exterior ridges of the wall is penetrated by numerous minute circular pores, and minute spinous processes project outwards from its surface. The spicular mesh of the interior appears to be of an irregular character.

This species is also abundant. It somewhat approaches to *V. radiatus* in the disposition of the ridges and furrows of the outer portion of the wall, but its mode of growth readily distinguishes it from that species. The *V. cavatus*, T. Smith, which is founded on a mere fragment of the wall of a sponge, appears to me to belong to the present species.

Distribution. Upper Chalk: South of England; Bridgwick; Monckton-Bassett, Wilts (*coll. T. Smith* and *Mantell*).

VENTRICULITES MAMMILLARIS, *Toulm. Smith.*

1848. *Ventriculites mammillaris,* T. Smith, Ann. & Mag. Nat. Hist. 2nd ser. vol. i. p. 213, t. 13. f. 7, 14.

1822. *Ventriculites radiatus,* Mantell, p. p. Foss. South Downs, t. 13. f. 2, 3, 5.

Sponges either elongated, narrow, funnel-shaped, or somewhat depressed, open

funnel- or cup-shaped. A slender cylindrical stem with branching roots is usually present, but in some examples the root-processes spring directly from the base of the funnel. The specimens vary from 50 to 120 mm. in height and from 20 to 75 mm. in width. The outer surface of the sponge-wall is folded into vertical ridges about 2·8 mm. in width, and these are divided transversely so as to form so many rows of rounded projecting wart-like bosses. The inner surface of the wall, according to Toulmin Smith's figure, appears to be composed of simple open furrows and ridges; but in none of the Museum specimens is the inner surface of the wall distinctly shown, and it cannot be seen in the type specimen from which T. Smith's figure has been drawn, so that this portion of the figure is purely imaginary. In a specimen preserved in flint the thickness of the wall is 4 mm.

The spicules of the interior mesh have conspicuous lantern or octahedral nodes; the spicular rays are about ·25 mm. in length.

This species differs from *V. decurrens* mainly in the warty projections of the outer wall.

Distribution. Upper Chalk: Sussex (*coll. T. Smith* and *Mantell*).

VENTRICULITES INFUNDIBULIFORMIS, *S. Woodward.* (Plate XXVI. figs. 1, 1 *a*.)

1833. *Ventriculites infundibuliformis,* S. Woodw. Geology of Norfolk, t. 4. f. 20, 21.

1848. *Ventriculites bicomplicatus,* T. Smith, Ann. &. Mag. Nat. Hist. 2nd ser. vol. i. p. 219, fig. E.

1848. *Ventriculites latiplicatus,* T. Smith, ibid. p. 215, fig. D.

1848. *Ventriculites striatus,* T. Smith, ibid. p. 212, t. 13. f. 6, 13.

1848. *Ventriculites radiatus,* T. Smith (non Mantell), ibid. p. 218, t. 13. f. 10, 15.

Sponges elongated funnel-shaped, sometimes laterally compressed above, or slightly expanding outwards; the divergent roots spring from the basal end of the funnel. The total thickness of the wall is from 7 to 8·5 mm.; the plaits forming the wall are about 1 mm. in thickness. I have not met with a complete specimen; the greatest width at the summit of an individual is 83 mm.

The exterior surface is composed of rounded, occasionally bifurcating ridges, about 1·8 mm. wide, which extend vertically from the base to the summit, and are connected laterally so as to leave narrow oval interspaces about 4 mm. in length by 1·25 mm. in width, which are sometimes disposed in quincunx. The inner surface of the wall is rarely exposed; it appears to be similar in character to the outer surface.

The spicular mesh is only shown by the empty moulds of the spicules in the Chalk; it appears to be irregular, with prominent octahedral nodes; the distance from node to node is ·38 mm.

The aspect of this species varies greatly, according as it happens to be preserved in the interior of flints or in chalk. As a general rule only the lower portions of the sponge are met with in flints, and these specimens do not show the oval inter-

spaces between the vertical ridges so conspicuously as in the Chalk examples. It is probable that T. Smith's figure of *V. striatus* has been drawn from one of the flint-inclosed examples of this species.

This species is readily distinguished by the great thickness of the wall and the characters of the outer surface. Though no description accompanies Woodward's figure, the examples from Norwich in the Museum collection enable me to identify the forms which he has placed under this name. Unfortunately the descriptions of species given by Toulmin Smith are very meagre and incomplete, and many of his figures are diagrammatic, so that reliance cannot be placed on them*. I have carefully examined Smith's specimens in the Museum, and regard the forms referred by him to *V. bicomplicatus*, *V. latiplicatus*, *V. striatus*, and *V. radiatus* as belonging to the present species.

Distribution. Upper Chalk: Norwich; Clopton, Suffolk; Heytesbury, Beckhampton, Moncton-Bassett, Norton-Bavant, Wiltshire; Wolsk, Volga, Russia (*coll. Bayfield, Cunnington, T. Smith*).

VENTRICULITES CRIBROSUS, *Phillips*, sp. (Plate XXVI. figs. 2, 2 *a*.)

1829. *Spongia cribrosa,* Phill. Geol. Yorkshire, t. 1. f. 7.
1864. *Ventriculites multicostatus,* F. A. Rœmer, Palæont. Bd. 13, p. 19, t. 8. f. 1.

Sponges elongated, narrow, funnel-shaped, very gradually tapering from the summit to the base; the root-processes usually spring from the basal end of the funnel, but in some instances a short stem intervenes. The wall is 6 mm. in thickness where it has not been compressed. A fairly complete specimen is 240 mm. in length by 55 mm. in width at the summit.

The outer surface is reticulate; the ridges of the wall, about 1·2 mm. in width, inosculate, so as to form elliptical interspaces, about 2·7 mm. in length by 1 mm. in width, which, in some, though not in all the specimens, are disposed in quincunx. The inner surface of the wall is concealed by the matrix. No spicular structure has been preserved.

This species, so far as can be judged from the unfavourable condition of the specimens, differs from *V. infundibuliformis* principally in its thinner wall and the smaller size of the ovate apertures of the outer surface. Phillips's figure is very inexact, but there can hardly be a doubt respecting the form which he intended to represent, since no other at all resembling it is found in the Chalk at Flamborough. The sponge which F. A. Rœmer has referred to this species (Nordd. Kreide, p. 9,

* It may also be mentioned here that the type of Toulmin Smith's *Ventriculites tessellatus* (Ann. & Mag. Nat. Hist. 2nd ser. vol. i. p. 211, t. 13. f. 2, 3, 4), now in the Museum, consists only of the impression of the outer surface of a small fragment of a sponge on a small piece of chalk. No spicular structure can be discerned, and it is doubtful whether the form even belongs to *Ventriculites*. The characters shown are altogether insufficient for specific determination.

t. 4. f. 2) differs from the Flamborough examples by its apparently thinner wall and the circular form of the surface-apertures; but, on the other hand, the *V. multicostatus* of the same author, so far as can be judged from the descriptions and figures, appears to be identical with Phillips's species.

Distribution. Upper Chalk: Flamborough, Yorkshire.

VENTRICULITES ANGUSTATUS, *Rœmer*, sp. (Plate XXVI. figs. 3, 3 *a*, 3 *b*.)

1840. *Scyphia angustata,* Rœmer, Nordd. Kreide, p. 8, t. 3. f. 5.
1854. *Scyphia angustata,* Morris, Cat. Brit. Foss. p. 29.

Sponges narrow, funnel-shaped, occasionally compressed, gradually tapering from the summit to the basal end. No stem or root has been preserved. The thickness of the wall in a silicified specimen is 5 mm., in specimens preserved in chalk it is about 3·5 mm. The length of what appears to be an average specimen is 95 mm., and the summit width is 26 mm.

The outer surface has an irregular reticulate aspect; in places the ridges of the wall, about ·9 mm. in width, are disposed vertically, and connected by lateral extensions, so as to leave transversely elliptical or irregularly subangular interspaces from ·8 mm. to 1·2 in width; in other parts of the same specimen the disposition of the ridges and interspaces is altogether irregular. The interior surface of the wall has circular apertures, 1 mm. wide, and nearly the same distance apart, arranged regularly in quincunx.

The spicular structure of the specimens is nearly obliterated, but I have ascertained the octahedral character of the nodes. The mesh appears to be irregular; the distance from node to node is ·35 mm. The dermal layer, both of the outer and inner surface of the wall, shows minute circular pores of different sizes.

This species can be readily distinguished from the funnel-shaped forms previously described by the characters of the outer surface. This closely agrees with Rœmer's figure of the type in the Nordd. Kreide; but it does not correspond with the forms which the same author referred to the species at a later date under the name of *Cylindrospongia angustata* *, nor with those which Ferd. Rœmer † and Quenstedt ‡ have referred to the species. This species appears to be rare.

Distribution. Upper Chalk: South of England.

VENTRICULITES ALCYONOIDES, *Mantell.*

1808. *An Alcyonite,* Parkinson, Organic Remains, vol. ii. p. 213, t. 10. f. 12.
1816. *Flint Alcyonite,* W. Smith, Strata Identified, t. 3. f. 1.
1822. *Ventriculites alcyonoides,* Mantell, Foss. South Downs, p. 176.

* Palæontographica, Bd. 13, p. 22, t. 8. f. 10.
† Geol. Oberschlesien, p. 309, t. 30. f. 7, 8.
‡ Petrefacten, Bd. 5, p. 457, t. 136. f. 2–14.

1870. *Cylindrospongia angustata,* Ferd. Rœmer, Geol. Oberschles. p. 309, t. 30. f. 7, 8.
1877. *Ventriculites angustatus,* Quenst. p. p. Petref. Bd. 5, p. 437, t. 136. f. 3, 11, 12, 14.

Sponges narrow, funnel-shaped or subcylindrical, sometimes with constrictions at intervals. In some examples the aperture at the summit is contracted. The basal end is seldom entire; the funnel appears to have been supported on a slender cylindrical stem. The wall appears to be about 4 mm. in thickness. In general the specimens are about 50 mm. in length by 20 in width, but larger forms occur, which, judging from fragments, would measure about 100 mm. long, with a summit-width of 36 mm.

The outer surface of the wall is reticulate; the ridges or folds, about 1 mm. wide, are disposed so as to leave circular or somewhat irregular interspaces, from ·75 to 1 mm. in width, arranged either in quincunx or without definite order. The interior surface of the funnel is not exposed.

The spicular mesh, as seen in a vertical section of a specimen, is irregular; the distance between the spicular nodes is ·375 mm.

It is sometimes difficult to separate some of the examples of this species which have the surface-apertures of the wall arranged in quincunx, from specimens of *Coscinopora* (*Ventriculites*) *quincuncialis*, T. Smith, sp. As a rule, however, the canal-apertures in this latter species are much smaller, and the surface is much more even than in *V. alcyonoides.* In specimens which show the spicular structure the difference is easily ascertainable, for in the type forms of *C. quincuncialis* the nodes are compact, whilst in the present species they are clearly octahedral.

The figures of Parkinson and Smith referred to by Mantell must be accepted as representing the type of the species, and not Mantell's description, which embraces more than one species. In the structure of the outer surface of the wall *Ventriculites alcyonoides* resembles *V. impressus*, T. Smith, and it is probable that the disciform examples of Mantell's description belong to this latter species.

This species appears to be abundant and generally distributed in the Upper Chalk.

Distribution. Upper Chalk: Wighton, Norfolk; Guildford, Surrey; Arundel, Lewes, Sussex; Boxley, Kent; Heytesbury, Norton-Bavant, Warminster, Wilts; Strehlen, Germany (*coll. Mantell, W. Smith, T. Smith*).

Genus SCHIZORHABDUS, *Zittel,* 1877.

Schizorhabdus libycus, *Zitt.*

1877. *Schizorhabdus libycus,* Zitt. Studien, I Ab. p. 51; Neues Jahrbuch, p. 361.

Distribution. Upper Chalk: Libyan Desert (*coll. Zitt.*).

Genus RHIZOPOTERION, *Zittel*, 1877.

Rhizopoterion cervicorne, *Goldf.* sp.

1826–33. *Siphonia cervicornis*, Goldf. Petref. 1 Th. p. 18, t. 6. f. 11, and p. 98, t. 35. f. 11.
1877. *Rhizopoterion cervicorne*, Zitt. Studien, I Ab. p. 51; Neues Jahrbuch, p. 362, t. 3. f. 6.
1878. *Siphonia cervicornis*, Quenst. Petref. Bd. 5, p. 422, t. 135. f. 9.

Two specimens of the stem and roots of a sponge preserved in flint probably belong to this species. The spicular structure has not been preserved, but the longitudinal canals very closely resemble those of typical examples from Germany.

Distribution. Upper Chalk: England; Bromberg, Haldem, Germany (*coll. Zitt.*).

Genus SPORADOSCINIA, *Pomel*, 1872, emend. *Zittel*, 1877.

Sporadoscinia micrommata, *Rœm.* sp.

1840. *Scyphia micrommata*, F. A. Rœmer, Nordd. Kreide, p. 7, t. 2. fig. 11.
1872. *Cribrospongia micromata*, Schlüter, Spongit. des Münsterlandes, p. 28.
1877. *Sporadoscinia micrommata*, Zitt. Studien, I Ab. p. 52; Neues Jahrbuch, p. 362, t. 3. f. 5.

Sponges cup-shaped or forming slightly concave expansions, supported on a short inverted-conical, hollow, basal portion. No root-processes have been preserved. The thickness of the wall is only 1 mm., but all the specimens have been replaced by peroxide of iron, and it is probable that the wall has suffered from compression. The height of a specimen is 45 mm. and the width across the summit is 105 mm.

The outer surface is furnished with irregularly disposed, circular or transversely ovate apertures, about ·9 mm. in width, and the same or a slightly greater distance apart from each other; the inner surface of the wall has elliptical apertures, about 1·3 mm. in length, disposed regularly in quincunx. No spicular structure has been preserved. The dermal layer appears to have been minutely porous.

Distribution. Upper Chalk; Bromley, Kent (*coll. T. Smith*).

Sporadoscinia Decheni, *Goldf.* sp.

1826–33. *Scyphia Dechenii*, Goldfuss, Petref. 1 Th. p. 219, t. 65. f. 6.
1877. *Sporadoscinia Decheni*, Zitt. Studien, I Ab. p. 52; Neues Jahrbuch, p. 362.
1878. *Scyphia Dechenii*, Quenst. Petref. Bd. 5, p. 454, t. 137. f. 2.

Microscopic fragments of the spicular structure of this species from the Upper Chalk of Coesfeld, Westphalia.

Sporadoscinia capax, *Hinde*, n. sp. (Plate XXVI. figs. 4, 4 *a*, 4 *b*.)

Sponge open funnel-shaped, growing to a large size; no stem has been preserved. The wall is 5 mm. in thickness; it is possible that it may have been originally of

somewhat greater thickness, though I do not think that in this instance it has been much compressed. The only specimen, which is destitute of the lower portion of the funnel, measures 170 mm. in height by 168 in width at the summit.

The outer surface of the wall is pierced with irregularly disposed, transversely elliptical or ovate apertures, from 1 to 1·8 mm. in length and about ·6 mm. in width. These apertures are only separated by slender wall-fibres, about ·7 mm. in width. The inner surface has circular or slightly ovate apertures, 1·6 mm. wide, and about the same distance apart, regularly disposed in quincunx.

Only a portion of the wall has been preserved, and the spicular structure is either in the condition of hollow moulds, or these are partially filled with peroxide of iron. The interior mesh appears to be very irregular; the distance between the octahedral spicular nodes is ·3 mm. The dermal layer appears to have been furnished with stout spines, which projected from the surface and into the canals in the same manner as represented by Zittel in *S. micrommata* *.

The main difference between this species and *S. Decheni*, Goldf., independent of its much larger size, consists in the different form and arrangement of the apertures of the outer surface of the wall.

Distribution. Lower Chalk: South of England.

Genus SESTROCLADIA, *Hinde*, n. g.

Sponge ramose, consisting of cylindrical or compressed bifurcating branches. The branches are hollow tubes, open at their summits. The outer surface of the sponge is formed by anastomosing ridges or folds with ovate interspaces. The interior surface is concealed by the matrix, but, judging from vertical and transverse sections, it appears to be penetrated by apertures similar to those of the outer surface. The spicular mesh of the interior of the wall is irregular, the spicular nodes are octahedral. The outer surface of the ridges or folds of the wall apparently possessed a dermal layer, but its minute structure is not discernible.

This genus is distinguished from all others of the family of the Ventriculitidæ by its dendritic mode of growth.

Sestrocladia furcatus, *Hinde*, n. sp. (Plate XXVII. figs. 1, 1 *a*, 1 *b*.)

Sponge apparently growing from a simple stem, which gives off divergent branches at irregular intervals. The branches have a generally upright direction of growth; they are from 15 to 28 mm. in diameter, usually cylindrical, but near the points of bifurcation they are frequently compressed and expanded. The single example, which is imperfect, is 155 mm. in height, and the lateral extension is 140 mm. The thickness of the wall is 3 mm.

* Neues Jahrbuch, 1877, Taf. 3. fig. 5 *a*.

The ridges or folds of the outer surface are about 1 mm. in width, and the ovate or somewhat irregularly elongate canal-apertures are from 1 to 2 mm. in length. The octahedral nodes of the interior mesh are clearly shown; the distance from node to node is about ·4 mm.

There is but a single specimen in the Museum collection, which had been named *Spongia ramosa*, Mantell; but beyond its mode of growth it has no other character in common with that species.

Distribution. Grey Chalk: Dover.

Genus CŒLOSCYPHIA *, *Tate*, 1865 (emend. *Hinde*).

This name was proposed by Tate† as a substitute for *Polycœlia*, Fromentel‡, which had been previously applied by Prof. King § to a genus of Actinozoa. As representing a natural genus of sponges, *Polycœlia*, From., is quite valueless, and the forms included therein by Fromentel and F. A. Rœmer have been placed by Zittel in two or three genera. It is needless therefore to adopt Tate's suggestion and substitute another term for a genus which is now obsolete. The particular species, however, that Tate placed under *Cœloscyphia* appears to me to belong to a distinct genus, and I therefore propose to retain his name for sponges with the following generic definition:—

Sponges consisting of simple cylindrical tubes growing from a common centre. The walls of the tubes regularly folded so as to form vertical subparallel ridges with intervening furrows. The spicular mesh with octahedral nodes.

This genus is intermediate between *Sestrocladia* and *Polyblastidium*. The non-branching character of the tubes and the vertical ridges of the wall distinguish it from the former genus, whilst the absence of a common tubular axis separates it from the latter.

CŒLOSCYPHIA SULCATA, *Tate*, sp. (Plate XXIX. figs. 1, 1 *a*.)

1865. *Cœloscyphia sulcata,* Tate, Quart. Journ. Geol. Soc. vol. xxi. p. 43, t. 5. f. 5.
1878. *Cœloscyphia sulcata,* Zitt. Studien, III Ab. p. 31, note.

The only specimen consists of three short subequal cylindrical tubes, 17 mm. in length and 9 in width, growing from a common centre. No stem has been preserved, but it is probable that one was originally present. The walls of the tubes are folded so as to form 12 to 14 vertical ridges; the intervening furrows are concealed by the matrix, which also fills the cloacal tube. The cloacal aperture is circular, and 3 mm. in width. The total thickness of the wall is about 3 mm., whilst the

* This genus is unintentionally omitted from the list on p. 16.

† Quart. Journ. Geol. Soc. vol. xxi. p. 43.

‡ Introduction à l'étude des Eponges fossiles, 1859, p. 32.

§ Annals & Mag. Nat. Hist. 1849, 2nd ser. vol. iii. p. 388.

wall-plaits are ·5 mm. in thickness. The spicular mesh is small; the octahedral nodes are ·3 mm. apart. The characters of the dermal layer are obliterated, and the interior spicular structure is only preserved in one or two places. The type specimen, the only one at present known, is in the Jermyn-Street Museum.

Distribution. Spongarian zone of the Chloritic Chalk (*Tate*) = Upper Chalk: Island Magee, near Belfast.

Genus POLYBLASTIDIUM, *Zittel*, 1877.

POLYBLASTIDIUM LUXURIANS, *Zitt.*

1877. ***Polyblastidium luxurians***, Zitt. Studien, I Ab. p. 52; Neues Jahrbuch, p. 363, t. 3. f. 7.

Microscopic portions of the spicular structure of this species.

Distribution. Upper Chalk: Linden, Hanover (*coll. Zitt.*).

POLYBLASTIDIUM RACEMOSUM, *Toulm. Smith*, sp. (Plate XXVII. figs. 2, 2 *a.*)

1848. ***Brachiolites racemosus***, T. Smith, Ann. & Mag. Nat. Hist. vol. i. p. 364, t. 15. f. 6.

Body of sponge club- or pear-shaped, supported on a slender stem, with divergent rootlets at its termination. From the surface of the sponge short projecting hollow tubes, from 8·5 to 14 mm. in diameter, project irregularly outwards. An average specimen is 77 mm. in length by 40 in width.

The examples of this species are all in solid flint, and only transverse sections of the tubular projections are shown on the outer surface of the flint. The walls of the tubes are 2·5 mm. in thickness; they are formed of regular plaits, ·5 mm. thick. The spicular mesh appears to be irregular; the distance between the octahedral nodes is ·25 mm.

This species differs from *P. luxurians*, Zitt., by the larger size and lesser number of the projecting tubes.

Toulmin Smith's figure is diagrammatic, and a very inaccurate representation of the original.

Distribution. Upper Chalk: Kent, Sussex (*coll. T. Smith*).

POLYBLASTIDIUM TUBEROSUM, *Toulm. Smith*, sp.

1848. ***Brachiolites tuberosus***, T. Smith, Ann. & Mag. Nat. Hist. vol. i. p. 354, t. 15. f. 3.

The type of this species is a fragment of a sponge, which has been partially cleaned from a chalky matrix. Only the general form, indicated by markings in iron peroxide, can be distinguished. The body of the sponge appears to have been a thin-walled, hollow, subcylindrical tube, with small bud-like projections on its exterior surface. The tubular axis is about 46 mm. in length by 16 in width. The projecting buds are 8 mm. in length; their summits are expanded and slightly concave.

No aperture can be detected in the summit of the buds; but the condition of the specimen is too imperfect for satisfactory determination. The figure of T. Smith's is to some extent a restoration of the original specimen. The closed summits of the bud-like projections distinguish this species from *P. luxurians*, Zitt.

Distribution. Upper Chalk: Kent? (*coll. T. Smith*).

Genus CEPHALITES, *Toulm. Smith*, pars, 1848.

Toulmin Smith included in this species a variety of forms, which have been separated by Prof. Zittel into two or three genera. As restricted by Zittel, the genus only includes those sponges which resemble *Ventriculites* in the foldings of the plaits of the wall, and possess the further characteristic that the summit of the sponge-wall is truncate and covered with a delicate siliceous membrane.

CEPHALITES LONGITUDINALIS, *Toulm. Smith.*

1847–48. *Cephalites longitudinalis,* T. Smith, Ann. & Mag. Nat. Hist. 1st ser. vol. xx. t. 7. f. 1, and 2nd ser. vol. i. t. 14. f. 1.

1848. *Cephalites guttatus,* T. Smith, ib. 2nd ser. vol. i. t. 14. f. 2.

1878. *Cephalites longitudinalis* and *guttatus,* Zitt. Studien, I Ab. p. 52; Neues Jahrbuch, p. 363.

Sponges narrow, funnel-shaped, with a short slender cylindrical stem, terminating in divergent rootlets. An average specimen is 68 mm. in length, and 25 in width at the summit. The wall varies from 4 to 13 mm. in thickness in different individuals. The exterior surface is formed by a series of longitudinal ridges about 3 mm. in width, more or less sinuous, and occasionally interrupted transversely so as to form rows of projecting bosses. The inner surface has numerous circular canal-apertures, 1·5 mm. wide, disposed in quincunx. The plaits forming the wall are about 1 mm. in thickness. The spicular mesh is irregular; the distance between the spicular nodes is about ·25 mm.

I am unable to detect specific differences between *C. guttatus* and *C. longitudinalis.* Even in the same specimen the outer surface will occasionally exhibit continuous ridges and rows of projecting bosses. The examples of this species are common; they are nearly all preserved in chalk, and the spicular structure is usually in the condition of iron peroxide. In some examples of this and other species of the genus this replacing material is sufficiently firm for the spicular mesh to remain intact after careful removal of the matrix, but it is of an extremely delicate character.

Distribution. Upper Chalk: Glynde, Westmeston, Sussex; Shalford, Surrey; Maidstone, Dover, Kent (*coll. T. Smith*).

is ·3 mm. The ridges of the outer surface of the wall of this species are more slender than in *C. Benettiæ*, and the form itself is smaller.

Distribution. Upper Chalk: South of England.

Cephalites bullatus, *Toulm. Smith.* (Plate XXVII. figs. 3, 3 *a*, 3 *b*.)

1847–48. *Cephalites bullatus*, T. Smith, Ann. & Mag. Nat. Hist. 1st ser. vol. xx. t. 7. f. 3, and 2nd ser. vol. i. p. 284, t. 14. f. 6.

1816. *Flint Alcyonite*, W. Smith, Strata identified by Org. Fossils, p. 7, t. 3. f. 2.

Sponges with a funnel-shaped or subcylindrical body, about 36 mm. in length, and from 21 to 36 mm. in width, supported on a delicate stem, with divergent rootlets at its termination. The wall varies from 5·5 to 12 mm. in thickness.

The wall of the outer surface is folded in such a manner as to form, on the surface of perfect specimens, small, flat-topped, lozenge-shaped or irregular projections, about 4 mm. wide, which are disposed in quincunx. The dermal membrane of these projections is minutely porous, and small, hollow, occasionally bifurcating, spines spring from its surface. The interior surface of the wall is perforated with circular or elliptical canal-apertures about 2 mm. in diameter. The plaits of the interior portion of the wall are about ·8 mm. in width; they are disposed in deep folds extending from the outer nearly to the inner surface, and *vice versâ*; they also form occasional loops.

This species is distinctly characterized by the features of the outer surface. T. Smith's figured specimen does not appear to be in the Museum Collection, but there are several examples labelled by him from which the above description has been taken. It appears to me very doubtful if the forms referred to this species by Reuss* and Quenstedt† really belong to it.

Distribution. Upper Chalk: South of England (*coll. T. Smith*).

Cephalites catenifer, *Toulm. Smith.*

1848. *Cephalites catenifer*, T. Smith, Ann. & Mag. Nat. Hist. 2nd ser. vol. i. p. 286, t. 14. f. 14, 15, 16.

1848. *Cephalites compressus*, T. Smith, ib. p. 287, t. 14. f. 10.

1877. *Toulminia catenifer* and *compressus*, Zitt. Studien, I Ab. p. 56; Neues Jahrbuch, p. 368.

Sponges funnel-shaped or inverted conical, supported on a slender stem. An average example is 48 mm. in length and 34 mm. in width; the stem appears to have been about 15 mm. in length. The wall is from 11 to 14 mm. in thickness. The outer surface of the wall is composed of ridges about 1·8 mm. in width,

* Verst. d. böhm. Kreide, II Ab. p. 74, t. 18. f. 11.

† Petref. Bd. 5, p. 484, t. 138. f. 10, 11.

disposed either in horse-shoe form or in irregular loops, so that the interspaces have a generally sinuous character. The interior, or cloacal surface, is perforated with cylindrical canal-apertures.

The interior of the wall is composed of plaits, about 1·25 mm. wide; seen in transverse section, they are arranged in deep folds with occasionally intervening loops. The spicular mesh of the plaits is more regular than in the preceding examples; the nodes are lantern or octahedral, and the distance from node to node is ·38 mm.

The *C. compressus*, T. Smith, appears to be merely the upper fragmentary portion of a specimen of *C. catenifer*. The original of Smith's figure, *l. c.* t. 14. f. 10, has no trace of a stem or root as represented in the figure. The representation of a transverse section of the plait in f. 15 is partly a restoration.

I am unable to follow Prof. Zittel in separating this species to form a distinct genus. Seen in transverse section, the plaits of the wall do not appear to be more complicated than in the typical forms of *Cephalites*, and they do not seem to possess the distinctive characters of the Meandrospongidæ.

Toulmin Smith has given a description and figure of another species of *Cephalites*, under the name of *C. retrusus**; but the figured type in the Museum Collection is merely a mould in wax, from which it is impossible to determine whether the specimen has been a sponge or not.

Distribution. Upper Chalk: South of England (*coll. T. Smith*).

Family *STAURODERMIDÆ*, Zitt.

Genus CYPELLIA, *Pomel* (*emend. Zitt.* 1877).

Cypellia rugosa, *Goldf.* sp.

1826–33. *Scyphia rugosa*, Goldf. Petref. 1 Th. p. 9, t. 3. f. 6.

1877. *Cypellia rugosa*, Zitt. Studien, I Ab. p. 53; Neues Jahrbuch, p. 364, t. 4. f. 1; Handbuch der Pal. 1 Bd. p. 179, f. 94.

Distribution. Upper Jura: Streitberg, Franconia.

Cypellia infundibuliformis, *Goldf.* sp.

1826–33. *Scyphia rugosa*, var. *infundibuliformis*, Goldf. Petref. 1 Th. p. 87, t. 32. f. 2.

1878. *Crucispongia annulata* and *cruciata*, Quenst. Petref. Bd. 5, p. 165, t. 123. f. 2–5.

Distribution. Upper Jura: Heuberg, Streitberg, Randen. Oolite inférieure: Verson, France.

* Annals & Mag. Nat. Hist. 1848, 2nd ser. vol. i. p. 285, pl. 14. f. 8.

CYPELLIA CÆSPITOSA, *Quenst.* sp.

1878. *Dolispongia cæspitosa hexamera,* Quenst. Petref. Bd. 5, p. 311, t. 130. f. 12.

Distribution. Upper Jura: Randen?

CYPELLIA LIBERA, *Quenst.* sp.

1878. *Nexispongia libera,* Quenst. Petref. Bd. 5, p. 162, t. 123. f. 1.

1878. *Cypellia prolifera,* Zitt. Neues Jahrb. p. 62.

Distribution. Upper Jura: Heuberg, Randen.

Genus STAURODERMA, *Zittel,* 1877.

STAURODERMA LOCHENSE, *Quenst.* sp.

1858. *Spongites Lochensis,* Quenst. Der Jura, p. 669, t. 81. f. 96.

1877. *Stauroderma Lochense,* Zitt. Studien, I Ab. p. 53; Neues Jahrbuch, p. 364, t. 4. f. 2.

Distribution. Upper Jura: Heuberg, Streitberg.

STAURODERMA CYLINDRATUM, *Quenst.* sp.

1858. *Spongites cylindratus,* Quenst. Der Jura, p. 686, t. 83. f. 8.

1878. *Cavispongia cylindrata,* Quenst. Petref. p. 158, t. 122. f. 19, 20.

As seen in a polished section, the interior structure of the wall of this species is composed of relatively large spicules with solid nodes, forming an irregular mesh similar to that of *Stauroderma Lochense.* I have not, however, detected any dermal layer of distinctive cross-shaped spicules; so that it is doubtful whether this form rightly belongs to the genus *Stauroderma* or not.

Distribution. Heuberg, near Balingen, Würtemberg.

Genus PURISIPHONIA, *Bowerb.* 1869.

PURISIPHONIA CLARKEI, *Bowerb.*

1869. *Purisiphonia Clarkei,* Bowb. Proc. Zool. Soc. p. 342, pl. 25. f. 6, 7.

1870. *Purisiphonia Clarkei,* Moore, Quart. Journ. Geol. Soc. vol. xxvi. pp. 235, 240, pl. 17. f. 1.

1878. *Purisiphonia Clarkei,* Carter, Ann. & Mag. Nat. Hist. 5th ser. vol. i. p. 376.

1878. *Purisiphonia Clarkei,* Zitt. Handbuch der Pal. vol. i. p. 179.

1878. *Purisiphonia Clarkei,* R. Etheridge, jun., Cat. Austral. Foss. p. 104.

Distribution. Lower Cretaceous?: Wollumbilla Creek, North Queensland, Australia (*coll. Bowerbank*).

Genus POROCYPELLIA, *Pomel* (*emend. Zitt.* 1877).

POROCYPELLIA PYRIFORMIS, *Goldf.* sp.

1826–33. *Scyphia pyriformis*, Goldf. Petref. 1 Th. p. 10, t. 3. f. 9.
1877. *Porocypellia pyriformis*, Zitt. Studien, I Ab. p. 53; Neues Jahrbuch, p. 364, t. 5. f. 1 *a*, *b*.

Distribution. Upper Jura: Streitberg (*coll. Zitt.*).

Genus CASEARIA, *Quenst.* 1858.

CASEARIA ARTICULATA, *Goldf.* sp.

1826–33. *Scyphia articulata*, Goldf. Petref. 1 Th. p. 9, t. 3. f. 8.
1858. *Casearia articulata*, Quenst. Der Jura, p. 681, t. 82. f. 9.
1877. *Casearia articulata*, Zitt. Studien, I Ab. p. 54; Neues Jahrbuch, p. 365, t. 5. f. 2 *a*, *b*.
1878. *Spongites articulatus*, Quenst. Petref. Bd. 5, p. 107, t. 120. f. 8–10, 12–21.

Distribution. Upper Jura: Streitberg; Heuberg; Heiligenstadt; Giengen; Randen.

Genus POROSPONGIA, *D'Orbigny*, 1852.

POROSPONGIA MARGINATA, *Goldf.* sp.

1826–33. *Manon marginatum*, Goldf. pars, Petref. 1 Th. t. 34. f. 9 *g*, *h*.
1877. *Porospongia marginata*, Zitt. Studien, I Ab. p. 55; Neues Jahrbuch, p. 366.

Distribution. Upper Jura: Heuberg, Würtemberg.

POROSPONGIA IMPRESSA, *Münst.* sp.

1826–33. *Manon impressum*, Münst. in Goldf. Petref. 1 Th. t. 34. f. 10.
1877. *Porospongia impressa*, Zitt. Studien, I Ab. p. 55; Neues Jahrbuch, p. 366; Handbuch der Pal. vol. i. (1878), p. 180, f. 95 *a*, *b*, *c*.

Distribution. Upper Jura: Streitberg; Muggendorf, Franconia (*coll. Zitt.*).

Genus OPHRYSTOMA, *Zitt.* 1877.

OPHRYSTOMA MICROMMATUM, *Rœm.* sp.

1864. *Porospongia micrommata*, Rœm. Pal. Bd. 13, p. 9, t. 4. f. 14.
1877. *Ophrystoma micrommatum*, Zitt. Studien, I Ab. p. 55; Neues Jahrbuch, p. 366.

Sponge growing in flattened expansions of various dimensions. An imperfect specimen is 80 mm. in width. The upper surface is smooth, and is provided with numerous, irregularly disposed, circular or ovate apertures, from 2·5 mm. to 4 mm. in width and from 2·5 to 7·5 mm. apart. When perfect these apertures have distinctly

elevated, crater-like margins. The under surfaces in all the specimens is firmly attached to the rocky matrix, and its characters are not visible. The thickness of the sponge is about 5·5 mm.

The upper surface, or dermal layer, is composed of a very delicate, minutely porous, siliceous network; the spicular structure is so minute that it is not distinguishable unless under the microscope; beneath this dermal layer the loose tissue of the interior skeleton is exposed. This is formed of spicules with stout arms and lantern nodes. The distance from node to node varies between ·28 and ·37 mm. In some places the interspaces of the mesh are filled with minute slender hexactinellid spicules, apparently disposed irregularly.

There are three examples of this species, which, so far as I am able to judge, correspond with Rœmer's figure and meagre description. One specimen is from the Grey Chalk, and is now calcareous in its composition; the other two, from the Chalk Marl, still retain in part their siliceous structure, and from these I have been able to ascertain the spicular characters.

Distribution. Chalk Marl: Ventnor. Grey Chalk: Dover.

OPHRYSTOMA OCELLATUM, *Seeley*, sp.

1873. *Porospongia ocellata,* Seeley, MS. See Proceedings Geol. Soc. vol. xxix. p. 68, pl. 6. f. 1–4.

1873. *Ventriculites cavatus,* Sollas (non T. Smith), Proc. Geol. Soc. vol. xxix. p. 68.

Sponges forming flattened or slightly curved expansions with rounded margins. The wall is from 3·5 to 5 mm. in thickness. The upper surface is perforated with oval apertures from 2 to 3 mm. in diameter, and about their own diameter apart, disposed in diagonal lines or irregularly. The margins of these apertures do not project as in the preceding species. The characters of the under surface are concealed in the specimens which I have examined.

The spicular mesh of the interior of the wall is of an open irregular character. The arms are robust, with prominent lantern nodes; the distance from node to node is ·4 mm. The spicular structure of the dermal layer has been obliterated.

This species differs from the preceding in its smaller size and more regular form, also in the generally smaller dimensions and regular disposition of the surface-apertures; the spicular structure of the interior is also more open, and the spicular arms are larger than in *O. micrommatum.* Only empty moulds of the spicular skeleton of the wall are preserved; good representations of these are given by Sollas (*l. c.*).

The name of this species was first given by Prof. Seeley to specimens in the Cambridge Woodwardian Museum; and it was afterwards figured by Sollas under the same designation, though in his description it is placed under the name of *Ventriculites cavatus,* T. Smith. There is, however, no alliance, beyond the common

possession of spicules with lantern nodes, between this form and the fragment of a sponge which T. Smith named *V. cavatus*.

Distribution. Green Sand: Cambridge. According to Prof. Seeley it also occurs in the Chalk at Hunstanton, Norfolk.

Genus PLACOTREMA, *Hinde*, gen. nov.

Sponges forming flattened expansions with rounded margins. The smooth upper surface is perforated with numerous apertures. The dermal layer is formed by large cross-shaped spicules, disposed over each other without any regularity; the interspaces between their arms are occupied by a very minute spicular mesh. The interior skeleton consists of a spicular mesh arranged so as to form delicate anastomosing laminæ. The nodes of the spicules are solid.

This genus differs from *Porospongia*, D'Orb., and *Ophrystoma*, Zitt., in the disposition of the interior mesh. From this latter genus also, which in general form it closely resembles, it is further distinguished by the different character of the dermal layer and the compact spicular nodes of the interior skeleton. It appears to be allied to *Placochlænia*, Pomel; but as the characters of the spicular mesh of this genus are not given by the author, it is not possible to compare this structure in the two genera; the dermal layer also differs from that of *Placochlænia*.

PLACOTREMA CRETACEUM, *Hinde*, n. sp. (Plate XXVII. figs. 4, 4 *a*, 4 *b*, 4 *c*.)

This sponge appears to have grown in flattened masses of an elliptical or ovate outline; the largest specimen is 60 mm. in length by 50 in width. The wall varies from 7 to 9·5 mm. in thickness. The apertures of the upper surface are ovate, with depressed margins, and disposed either in diagonal rows or irregularly. They are from 2·5 to 4 mm. in width.

The large cross-shaped spicules of the dermal layer are of various sizes; the ray of a fairly large specimen measures 1·5 mm. Some, if not all, of these surface-spicules appear to have had a fifth ray, which penetrated the dermal layer at right angles to the surface. The wall-plaits of the interior are ·75 mm. in width; the spicules of the mesh are relatively small, and the distance from node to node is ·25 mm.

The specimens are preserved in chalk; the spicules have been dissolved, and only empty casts or infiltrations of iron peroxide remain.

Distribution. Upper Chalk: Kent and South of England (*coll. Mantell* and *Toulm. Smith*).

Genus CINCLIDERMA, *Hinde*, gen. nov.

Sponges inverted conical or funnel-shaped. The exterior surface consists of a very smooth dermal layer formed by large cross-shaped spicules, disposed in such a

regular manner as to leave quadrate or oblong interspaces like lattice-work. An extremely delicate tissue, composed of much smaller and more slender spicules, disposed without any regularity, fills the spaces formed by the regular framework of the larger spicules, the whole forming an apparently compactly interwoven dermal layer.

The interior of the funnel formed by this dermal layer is occupied by anastomosing meandriform laminæ or thin walls of spicular tissue similar to those which characterize the genus *Plocoscyphia*. The spicular tissue is of a very irregular character, and the spicular nodes are solid.

In this genus the features which distinguish the families of the Staurodermidæ and the Meandrospongidæ appear to be present: the large cross-shaped spicules of the dermal layer are essentially similar to those of the former family, and the disposition of the internal spicular mesh is the same as in the latter family.

There is a certain resemblance between the markings on the outer surface of the small conical sponges of the genus *Eubrochus*, Sollas, and the present genus; but so little is known both of the exterior and interior structure of *Eubrochus*, owing to the imperfect preservation of the specimens, that it is impossible to institute a comparison between these genera. The spicular structure both of the dermal layer and of the interior wall of *Cincliderma* is, however, altogether different from the magnified representation of these structures in *Eubrochus* as given by Sollas*.

CINCLIDERMA QUADRATUM, *Hinde*, n. sp. (Plate XXVIII. figs. 1, 1 *a*, 1 *b*, 1 *c*, 1 *d*.)

The broken-up fragments of this species appear to have formed part of a funnel-shaped specimen, 46 mm. in width at its summit. The dermal layer is extremely thin, and formed by a single layer of spicules; the rectangular spaces, bounded by the larger spicules, vary in size between ·75 mm. and 1·8 mm. The rays of the large spicules overlap each other, and they all possess a fifth ray extending into the wall. In a few instances the smaller spicules of the interspaces of the lattice-work are disposed so as to divide them further into smaller quadrate spaces; but, as a general rule, these smaller spicules are disposed indiscriminately over each other. The anastomosing wall-plaits of the interior of the sponge are about 1·8 mm. in thickness; the spicules of the mesh are relatively large, and very irregular in form.

The sponge is preserved in chalk; and the siliceous spicular structure has been either replaced by iron peroxide or it has been dissolved, leaving empty moulds in the chalk.

Distribution. Upper Chalk: South of England (*coll. T. Smith*).

* Geological Magazine, Dec. 2, vol. iii. pl. 14. figs. 3, 4, 5.

Genus EUBROCHUS, *Sollas*, 1876.

Eubrochus clausus, *Sollas*.

1876. ***Eubrochus clausus***, Sollas, Geol. Mag. vol. iii. n. s. p. 398, t. 14.
1877. ***Eubrochus* ——**, Zitt. Studien, I Ab. p. 46.

Small, inverted conical sponges, with truncated or rounded summits. The lateral surfaces are covered with continuous fine linear grooves, which decussate with each other in such a manner as to form small quadrate or oblong interspaces, the sides of which are about ·5 mm. in length. The summit of the sponge is also covered with a similar lattice-work, but the lines forming it do not decussate as on the sides, but are disposed at right angles to each other. The characters of the interior structure of the sponge are too imperfectly preserved for satisfactory determination. Prof. Sollas has figured fragments of spicular mesh (*loc. cit.* figs. 4, 5) with which, he states, the interior of the sponge was filled; but after a careful examination of the type specimens in the collections of the Woodwardian Museum at Cambridge and of the Jermyn-Street Museum, I could only detect in the sections of the interior a few broken-up fragments of hexactinellid spicules, which were altogether insufficient to give me a clue to the original structure of the interior skeleton.

Distribution. Cambridge Green Sand: Cambridge (*coll. Tracy*).

Genus PROTOSPONGIA, *Salter*, 1864.

Protospongia fenestrata, *Salter*. (Plate XXVIII. fig. 2.)

1864. ***Protospongia fenestrata***, Salt. Quart. Journ. Geol. Soc. vol. xx. p. 238, t. 13. f. 12 *a*, *b*.
1871. ***Protospongia fenestrata***, Hicks, Quart. Journ. Geol. Soc. vol. xxvii. t. 16. f. 20.
1877. ***Protospongia fenestrata***, Zitt. Studien, I Ab. p. 45; Neues Jahrbuch, p. 354.
1880. ***Protospongia fenestrata***, Ferd. Rœmer, Leth. Geogn. 1 Th. p. 316, f. 59.
1880. ***Protospongia fenestrata***, Sollas, Quart. Journ. Geol. Soc. vol. xxxvi. p. 364, f. 1.

Form of sponge unknown; the portions preserved consist either of detached spicules or fragments of a delicate spicular framework formed of a single layer of four-rayed spicules of various dimensions. The larger spicules are arranged so as to form regular squares, which are divided by smaller spicules into smaller squares, and these are again subdivided; so that the surface of a fairly complete specimen resembles minute lattice-work. It is probable that a delicate spicular membrane connected the entire framework together, as there is in many specimens a thin film of iron pyrites between the interspaces of the lattice-work; and as the larger spicules are now in the condition of iron pyrites, this film of the same material may represent a spicular membrane whose minute rays have been indistinguishably merged together.

The not infrequent occurrence of portions of the spicular framework with the

spicules in their proper relative positions, is strong evidence that they were held together by a common membrane; and the presence of such a membrane in sponges with a similar lattice-like framework of large spicules, as in *Cincliderma quadratum* for example, also points to the same conclusion.

Whether this exterior spicular framework constituted the entire sponge is an open question; at present it is the only structure which has been discovered.

Prof. Zittel* is of the opinion that this and the following genus will probably constitute a new family; but as nothing is at present known of the interior characters of these sponges, I prefer to place them provisionally in the family of the Staurodermidæ on account of their resemblance to the dermal layer of some of the sponges of this family.

Distribution. Menevian: St. David's, South Wales. Lower Lingula Beds: Tyddyngwladis. Upper Mawddach: North Wales. Also in black shales of Cambrian age in Norway and Sweden.

Genus DICTYOPHYTON, *Hall*, 1863.

Dictyophyton tuberosum, *Conrad*, sp. (Plate XXVIII. fig. 3.)

1842. *Hydnoceras tuberosum,* Conrad, Journ. Ac. Nat. Sci. Philad. vol. viii. 1st ser. p. 267, t. 16. f. 1.

1863. *Dictyophyton tuberosum,* Hall, 16th Report of State Cab. New York, p. 90, t. 3. f. 1.

1879. *Dictyophyton,* sp., Schimper, Handbuch der Pal. 2 Bd. 1 Lief. p. 69.

1880. *Dictyophyton tuberosum,* Ferd. Rœmer, Leth. Geogn. 1 Th. p. 127, f. 3.

1882. *Dictyophyton,* Zitt. Neues Jahrbuch, II Bd. p. 204.

Sponges inverted conical or elongated funnel-shaped, apparently subangular in horizontal section when uncompressed, with projecting nodes disposed in horizontal and vertical rows. Neither the basal extremity nor the summit has been preserved. A fairly large, though incomplete, specimen is 190 mm. in length by 70 in width.

The surface of the sponge is divided into quadrate and oblong spaces by horizontal and vertical grooves or raised lines, of varying depth and strength, crossing each other at right angles. The stouter lines and grooves form the larger squares, the sides of which are from 4 to 6 mm. in length, and these are divided and subdivided by finer lines precisely in the same manner as in *Protospongia.* No structure can be detected in the interior of the funnel.

Nothing beyond the outer form and quadrate impressions of the outer surface, in a matrix of micaceous sandstone, remains of this sponge. The regular framework of the surface, however, so closely resembles that of *Protospongia* that there is every reason to suppose that it has been formed by the casts of spicules of different dimensions, disposed so as to form a regular lattice-work, as in that genus. It is also

* Neues Jahrbuch für Mineralogie &c., 2 Bd., 1882, p. 204.

probable that this framework was held together by a delicate spicular membrane, for crushed examples occur in which portions of the framework are frequently displaced without having the symmetrical arrangement destroyed; but in some instances the spicules are broken up and mingled together, in the same manner as in certain specimens of *Protospongia.*

This form was originally regarded by Conrad as a subgenus of *Orthoceras*; it was afterwards referred by Hall to marine Algæ. Still later Prof. Schimper expressed doubts of its being a plant, and stated that the structure much nearer resembled the skeleton of siliceous sponges. Prof. Ferd. Rœmer rightly compared the structure with that of *Tetragonis Danbyi*, M'Coy, with which it is undoubtedly congeneric. After this Mr. R. P. Whitfield *, without being aware of Schimper's and Rœmer's comparisons of the genus to sponges and allied forms, or at all events without mentioning the fact, refers *Dictyophyton* and some other genera to sponges like the recent *Euplectella.*

Hall enumerates eight other species of *Dictyophyton*, based on differences of outer form; it is probable that they may be all included in the present species. The *Tetragonis Eifeliensis*, Rœmer, very closely resembles the present form, and there can be hardly a doubt of its belonging to the same genus.

Distribution. Chemung Group, Upper Devonian: Cohocton, Steuben County, Western New York.

DICTYOPHYTON DANBYI, *M'Coy*, sp.

1855. *Tetragonis Danbyi,* M'Coy, Brit. Pal. Foss. p. 62, pl. 1 D. f. 7 & 8.
1880. *Tetragonis Danbyi,* Ferd. Rœmer, Leth. Geogn. 1 Th. p. 304.

Sponge subconical or subovate, imperfect both at the basal end and at the summit. Length about 25 mm. The surface is divided into larger and smaller squares by apparently continuous lines, in the same manner as in the preceding species, but the sides of the larger squares are not more than 1·5 to 2 mm. in length, thus very much smaller than in *D. tuberosum.*

Both M'Coy and Rœmer have referred this form to the genus *Tetragonis*, Eichwald; but the typical species of this genus, *T. Murchisonii*, Eichw. †, though presenting a superficial resemblance to the present form, possesses a structure of a quite different character. From an examination of undoubted forms of *Tetragonis* from the Silurian of Gotland, I believe that it is a sponge, and that it is very closely allied to *Ischadites*, Murch.

Dictyophyton Danbyi differs from *D. tuberosum*, Conrad, and *D. Eifeliensis*, Rœmer, in its smaller size and the slighter character of the spicular framework. The only specimen which I have seen is M'Coy's figured type in the Woodwardian

* American Journal of Science, vol. xxii. p. 53.

† Urwelt Russlands, Heft 2, p. 81, t. 3. f. 18.

Museum at Cambridge. The specimen is preserved in a matrix of micaceous sandstone.

Distribution. Silurian. Upper Ludlow: Brigsteer, Kendal, Westmoreland.

Genus PLECTODERMA, *Hinde*, n. g.

Outer form of sponge unknown; the only structures preserved are fragments of a thin spicular membrane, consisting of cruciform and five-rayed spicules of relatively large size, which are grouped together into continuous rows by the apposition and overlapping of several of their vertical axes, whilst the rays of their lateral axes extend singly on either side of the vertical rows and overlap those from the adjoining rows, thus forming an irregular framework. Smaller spicules are present between the interspaces of the larger forms, but they do not appear to be arranged in definite order.

This genus is closely related to *Protospongia*, Salter, and *Dictyophyton*, Hall, but it may be readily distinguished from either of these genera by the less regular character of the spicular framework and the absence of definite larger and smaller squares. From *Protospongia* it is further distinguished by the disposition of the spicules of the vertical rows in small bundles instead of in a single series. Whether the spicules in *Dictyophyton* were arranged singly or in bundles is not known, as no spicular structure has been retained.

PLECTODERMA SCITULUM, *Hinde*, n. sp. (Plate XXXI. figs. 1, 1 *a*, 1 *b*.)

The examples of the species occur on the fractured surfaces of a soft micaceous shaly rock. The vertical rows are about 7·5 mm. apart from each other; they consist of a variable number, generally from five to ten, of the spicular axes in pretty close juxtaposition. The spicules vary in size, from slender forms not more than ·09 mm. in thickness, to large spicules with rays ·35 mm. in thickness and 6·5 mm. in length. The spicules are now mostly represented by empty moulds, and at first sight appear as so many monaxial spicules crossing each other at right angles; but in places where they are less thickly grouped together, the four rays, springing from a common centre, can be clearly seen, and at the point of junction there is often a small circular hole, indicating a fifth ray, extending inwards at right angles to the other four. The spicular rays are straight, curved, or occasionally wavy; they usually taper from the central node. In some instances fragments of the original siliceous spicules yet remain, but they are so far decayed as readily to fall into minute pieces. In some cases the central canal can be seen in these fragments. Whether the framework of larger spicules was held in position by a continuous membrane of smaller spicules, as in the dermal layer of the Cretaceous genus *Cincliderma*, cannot be so readily determined; but traces of smaller spicules, irregularly disposed between

the larger rays, can be occasionally seen, so that there is great probability that a continuous membrane was originally present.

Distribution. Silurian strata of Upper Ludlow age: Wetherlawlinn, Pentland Hills, near Edinburgh. The specimens belong to the collection of the Geological Survey of Scotland, and were discovered by Mr. James Bennie.

Family *MEANDROSPONGIDÆ*, Zittel.

Genus PLOCOSCYPHIA, *Reuss*, 1846.

PLOCOSCYPHIA FENESTRATA, *T. Smith*, sp. (Plate XXVIII. figs. 4, 4 *a*, 4 *b*, 4 *c*.)

1848. *Brachiolites fenestratus*, Toulm. Smith, Ann. & Mag. Nat. Hist. 2nd ser. vol. i. p. 367, t. 16. f. 3.

Sponges subcylindrical, hemispherical, or irregular in form, oftentimes growing in close contact with each other, so as to form masses of considerable size. The outer surface is composed of numerous anastomosing, subcylindrical, open tubes, from 4 to 8 mm. in diameter. The central portion of the sponge, as seen in a transverse section, appears to consist of open anastomosing folds of the sponge-wall, which, when simple, are about 2 mm. in thickness; but the folds sometimes coalesce laterally, and are consequently of increased thickness.

The spicular structure of the interior of the wall-plaits is generally regular; the spicules form a rectangular oblong mesh with elliptical interspaces. The distance between the nodes varies from ·3 to ·4 mm. The spicular arms are robust, smooth, or with blunt spines, and about ·08 mm. in thickness. The dermal layer is composed of an irregular spicular network, with minute circular or ovate pores; the nodes of the spicules are solid, whilst those of the interior of the wall are octahedral or lantern-like.

This is a well-marked species, and readily recognizable by the size and disposition of the tubes of the exterior surface. In the numerous specimens in the Museum from T. Smith's collection, and labelled by him, I have not found one which corresponds with the figure which he has given of this form. This figure appears to me to be diagrammatic merely, and altogether misleading.

Distribution. Upper Green Sand: Dover and Folkestone. Chalk Marl: Ventnor, Isle of Wight; Norton Bavant, Wilts.

PLOCOSCYPHIA LABROSA, *Toulm. Smith*, sp. (Plate XXIX. fig. 2.)

1848. *Brachiolites labrosus*, T. Smith, Ann. & Mag. Nat. Hist. 2nd ser. vol. i. p. 368, t. 16. f. 4.

1878. *Antrispongia dilabyrinthica*, Quenst. Petref. Bd. 5, p. 474, t. 137. f. 24.

1842. Compare *Spongus meandrinoides,* Leymerie, Mém. Géol. Soc. de France, vol. v. p. 1, t. 1. f. 2.

Sponges growing in subspherical, ovate, and irregular masses of very various dimensions. A small specimen is 90 mm. in diameter, and a large example measures 190 mm. across. The mass is composed of anastomosing folds of wall, from 2·5 to 3 mm. in thickness, which in some specimens form wide anastomosing tubes, and in other examples open meandriform folds. There are numerous intermediate examples between the tubular forms and those with open folds, and frequently the two characters are met with in the same specimen. The surface of the wall is perforated on both sides by the apertures of blind canals, from ·5 to ·75 mm. in width.

The dermal layer is composed of a minute spicular network with circular or ovate pores; the spicular mesh of the interior of the wall is irregular in its disposition; the distance from node to node is ·25 mm.; the lantern character of the nodes is distinctly shown.

This species differs from the preceding in the disposition of the folds of the wall, and in the closer and less regular character of its interior mesh. Mr. F. G. H. Price * has named this form *Plocoscyphia meandrina,* Leymerie, which I presume is the same as the *Spongus meandrinoides* of this author. Leymerie's figure, however, appears to me to represent a form differing from Smith's in the thinner walls and closer arranged folds. As the French typical specimen is only a cast in iron pyrites, no other comparison beyond that of outer form and the thickness of the wall-folds is practicable, and in both these features it differs from *P. labrosa.*

This species is extremely abundant in certain zones of the Upper Green Sand and Chalk Marl.

Distribution. Upper Green Sand and Chalk Marl: between Folkestone and Dover.

PLOCOSCYPHIA PERTUSA, *Geinitz.*

1843. *Tragos pertusum,* Geinitz, Die Versteinerungen von Kieslingswalda, p. 19, t. 6. f. 18.
1871. *Plocoscyphia pertusa,* Gein. Palæont. Bd. 20, p. 26, t. 2. f. 5 *a, b,* and t. 3. f. 1 *a, b.*
1878. *Plocoscyphia pertusa,* Zitt. Handb. der Pal. p. 181, f. 96.
1883. *Plocoscyphia pertusa,* Keeping, Fossils of Upware &c. p. 145, t. 8. f. 1 *a,* 1 *b.*

Sponge irregular in form, built up of convoluted walls, about 1·75 mm. in thickness, disposed so as to leave wide channels or anastomosing cylindrical tubes, about 8 mm. in diameter. The exterior surface is rough and uneven, and is furnished with numerous irregularly distributed circular or elongate canal-apertures.

The dermal layer is composed of a stout spicular mesh; the spicular arms are flattened and spinous, and the nodes solid; the interspaces of the mesh are mostly circular. The interior spicular mesh has subquadrate interspaces. The nodes are lantern-like; the distance from node to node is ·25 mm.

* Quart. Journ. Geol. Soc. 1877, vol. xxxiii. p. 442.

The above description is taken from a beautifully preserved fragment of this species presented to the Museum by Prof. Zittel.

According to Mr. Keeping this species occurs in the Neocomian beds at Brickhill; but the figure given is insufficient for me to determine whether the specimen is rightly referred to this species.

Distribution. Pläner-Kalk (Upper Green Sand): Bannewitz, Saxony. Neocomian: Brickhill, Bedfordshire (*Keeping*).

PLOCOSCYPHIA RETICULATA, *Hinde*, n. sp. (Plate XXIX. figs. 3, 3 *a*, 3 *b*.)

Sponge growing in irregularly shaped masses; the convoluted walls, 3·5 mm. in thickness, are disposed so as to form at the surface subcylindrical tubes from 11 to 16 mm. in diameter. The outer surface of the wall has a reticulate aspect from numerous circular or ovate canal-apertures, ·75 to 1 mm. in width, and about their own diameters apart. The canals are blind, and apparently are oftentimes curved in their course in the wall.

The dermal layer is composed of robust spicules with flattened arms and compact nodes; in places small spines project outwards; the interspaces are circular. The spicular mesh of the interior of the wall is irregular; the spicular nodes are ·22 mm. apart; the mesh is subquadrate or circular.

This species approaches in general appearance very closely to *P. pertusa*, Gein., but the walls are much thicker and the canal-apertures larger. From *P. labrosa*, T. Smith, it may be distinguished by its thicker walls and the disposition of the canal-apertures.

Distribution. Upper Green Sand: Eastbourne. Chloritic Marl: Rocken End, Isle of Wight.

PLOCOSCYPHIA SUBRUTA, *Quenst.* sp.

1878. *Gyrispongia subruta,* Quenst. Petref. Bd. 5, p. 480, t. 138. f. 2–6.

Sponges subcylindrical or club-shaped, with rounded summits. An apparently average specimen is 110 mm. in length by 38 in width. The outer surface has numerous circular or ovate apertures from 4 to 10 mm. in width.

The sponge is composed of convolute walls, 2 mm. in thickness; the outer surface consists of a spicular network, with definite canal-apertures ·75 mm. in width; the spicular arms are smooth, and the nodes compact. The spicular mesh of the interior of the wall has lantern nodes, the spicular arms are 2 mm. in length.

Quenstedt states* that *Achilleum formosum*, Reuss, probably belongs to this species; but though there is a great resemblance in outer form, the spicular mesh of *A. formosum* is composed of spicules with solid nodes, entirely different from those of Quenstedt's form.

Distribution. Chalk Marl: Rocken End, Isle of Wight.

* Böhm. Kreide, p. 79, t. 43. f. 7.

PLOCOSCYPHIA CONVOLUTA, *Toulm. Smith*, sp.

1848. *Brachiolites convolutus*, T. Smith, pars, Ann. & Mag. Nat. Hist. vol. i. p. 355, t. 15. f. 5, non fig. N. p. 357.

Sponge growing in small masses of irregular form, composed of delicate convoluted walls about 1 mm. in thickness. Traces of a minutely perforated dermal layer are present in one example; the interior of the wall is built of an irregular slender spicular mesh; the distance between the nodes is ·25 mm. The spicules have been replaced by iron peroxide, and the character of the nodes cannot be determined.

Toulmin Smith states that "the structure of the simple membrane (or wall) in this species seems coarse—that is, the squares (of the mesh) are larger than in any other species of the Ventriculitidæ." Such, however, is not the case in the specimen which he has figured, and which I have taken as the type of the species. The interspaces of the mesh in this example are relatively small. In the original specimen there are no traces of the minute stem and root represented in the figure given by Smith.

Distribution. Upper Chalk: South of England (*coll. T. Smith*).

PLOCOSCYPHIA FLEXUOSA, *Mantell*, sp. (Plate XXIX. fig. 4.)

1822. *Choanites flexuosus*, Mant. Foss. of the South Downs, p. 179, t. 15. f. 1.
1848. *Brachiolites convolutus*, T. Smith, pars, Ann. & Mag. Nat. Hist. vol. i. p. 357, fig. N.
1878. *Gyrispongia labyrinthica*, Quenst. Petref. Bd. 5, p. 485, t. 138. f. 12, 13.

Sponges inverted conical, or irregular in form, in some instances supported on a cylindrical stem with divergent rootlets at its termination. The body of the sponge is composed of convolute anastomosing walls from 1·25 to 1·7 mm. in thickness. The surface of the walls has numerous circular canal-apertures, ·6 mm. in width. The spicular mesh of the interior is somewhat irregular in disposition; the distance between the octahedral nodes, or the diameter of the interspaces of the mesh, varies between ·35 and ·4 mm.

The type of this species, now in the Museum, is the lower portion of a specimen preserved in flint, showing a section of the convolute walls and traces of the spicular mesh. Numerous other examples, both in flint and in chalk, exhibit walls of the same thickness, and a spicular mesh with interspaces of the same size as those of the type. In none of the specimens has the outer form been completely preserved; so that the only characters available for specific determination are the thickness of the walls and the dimensions of the mesh interspaces. The sponges figured by Quenstedt under the name of *Gyrispongia labyrinthica* appear to correspond with the present species; but I am unable to determine whether the *Plocoscyphia labyrinthica* of Reuss* and F. Rœmer† belong to it.

Distribution. Upper Chalk: South of England (*coll. Mantell, T. Smith*).

* Böhm. Kreide, II Ab. p. 77, t. 18. f. 10.

† Geol. Oberschles. p. 309, t. 33. f. 7.

PLOCOSCYPHIA LABYRINTHICA, *Mant.* sp. (Plate XXIX. fig. 5.)

1822. *Spongus labyrinthicus*, Mant. Foss. of the South Downs, p. 165, t. 15. f. 7.

Sponges irregular in form, composed of anastomosing walls arranged in open convolutions. The walls are from 2·5 to 3 mm. in thickness; their outer surfaces are perforated by circular canal-apertures about ·7 mm. in width. The distance between the nodes of the interior mesh varies from ·33 to ·4 mm.

The examples of this sponge are usually preserved in hemispherical nodules of flint, which exhibit on their flattened upper surfaces sections of the convolute walls. This species is distinguished from *P. flexuosa* by the greater thickness of the walls and the more open character of the convolutions, whilst the size of the spicular mesh appears to be similar.

Distribution. Upper Chalk: Bridgwick; Offham, Kent (*coll. Mantell*).

PLOCOSCYPHIA VAGANS, *Hinde*, n. sp. (Plate XXIX. figs. 6, 6 *a*.)

Sponges irregular in form, with convoluted walls about 1·5 mm. in thickness. The spicular mesh is composed of large spicules with lantern nodes; the distance between the nodes varies between ·625 and ·8 mm.

The examples of this species are all preserved in chalk, and the spicular mesh is now changed to iron peroxide or shown by empty moulds. The species is readily distinguished from those previously described by the unusually large size of the spicules of the interior mesh of the wall.

Distribution. Upper Chalk: Maidstone, Kent, and other localities in the South of England (*coll. T. Smith*).

PLOCOSCYPHIA FOLIACEA, *Toulm. Smith*, sp.

1848. *Brachiolites foliaceus*, T. Smith, Ann. & Mag. Nat. Hist. vol. i. p. 364, t. 16. f. 1.

Sponges club-shaped, usually curved in the lower portion, with a few small divergent rootlets at the base, the summits rounded. The outer surface smooth, with irregularly disposed rounded elevations and depressions. A fairly large example measures 155 mm. in length, and 48 in width at the summit.

The body of the sponge is composed of anastomosing walls from 1 mm. to 1·75 in thickness, disposed in open convolutions.

The examples of this species are preserved in chalk, and the spicular structure is only indicated by markings in iron peroxide, in which the character of the mesh has been obliterated. Its form and the features of the outer surface distinguish it from other species of this genus. Toulmin Smith's figure of this form is partly a restoration.

Distribution. Upper Chalk: South of England (*coll. T. Smith*).

Plocoscyphia elegans, *T. Smith*, sp.

1848. *Brachiolites elegans,* T. Smith, Ann. & Mag. Nat. Hist. vol. i. p. 355, t. 15. f. 4.
1878. *Brachiolites elegans,* Quenst. Petref. Bd. 5, p. 490, t. 138. f. 15.

Sponges with a subspherical body, supported on a slender cylindrical stem, terminating in divergent rootlets. From the summit of the body an upright cylindrical tube extends. The body of an average specimen is 47 mm. in height by 32 in width; the cylindrical tube measures 46 mm. in length by 23 in width; and the stem is 43 mm. long. The outer surface of the body presents rounded sinuous elevations and depressions; that of the tube is smooth and even.

The body is composed of anastomosing folds of wall about 1 mm. in thickness; the tube appears to be hollow, and formed of a simple extension upwards of the body-walls. The dermal layer appears to have been furnished with minute circular canal-apertures, the spicular mesh is regular, and the distance between the nodes is ·35 mm. The characters of the spicular nodes have been obliterated.

The peculiar form of this species readily distinguishes it from any other of the genus. T. Smith's figure has been drawn from two separate specimens, and is, to a certain extent, a restoration of the originals.

Distribution. Upper Chalk: Brighton, Sussex; Hollingbourne, Birling, near Maidstone, Kent *(coll. T. Smith)*.

Genus TREMABOLITES, *Zitt.* 1877.

Tremabolites perforatus, *T. Smith*, sp.

1848. *Cephalites perforatus,* T. Smith, Ann. & Mag. Nat. Hist. vol. i. t. 15. f. 2.

Sponges subcylindrical or club-shaped, with rounded summits. The sponge is composed of anastomosing, convoluted walls about 1 mm. in thickness. The summit is covered with an apparently delicate surface-membrane, which is perforated by several circular or oval apertures from 3 to 7 mm. in width. The spicular mesh of the walls is irregular; the nodes are octahedral, and from ·4 to ·5 mm. apart.

I am unable to determine the extent of the resemblance of the interior structure of this species to that of *Tremabolites* (*Manon*) *megastoma*, F. A. Rœm.*, but its outer form, at all events, considerably differs. The forms figured by Quenstedt† under the name of *Cephalites polystoma* differ from the present species in the extension of the surface-membrane over the sides as well as the summit of the sponge.

Distribution. Upper Chalk: South of England *(coll. T. Smith)*.

* Nordd. Kreide, p. 3, t. 1. f. 9.

† Petref. Bd. 5, p. 503, t. 139. f. 8–10.

Genus ETHERIDGIA, *Tate*, 1865.

ETHERIDGIA MIRABILIS, *Tate*.

1865. ***Etheridgia mirabilis***, Tate, Quart. Journ. Geol. Soc. vol. xxi. p. 43, t. 5. f. 4 *a*, 4 *b*.
1877. ***Etheridgia mirabilis***, Zitt. Studien, I Ab. p. 56; Neues Jahrbuch, p. 367.

Sponge conical with truncated summit, the base depressed, convex, with short, projecting cylindrical root-processes. At the summit is a circular aperture 15 mm. wide. The sides of the cone are provided with circular or elliptical apertures about 4 mm. in diameter. The type specimen is 33 mm. in height and 40 mm. in width. A compact dermal membrane extended over the base and sides. The interior structure has been completely obliterated. The only specimens known are in the Jermyn-Street Museum.

Distribution. Spongarian zone of the Chloritic Chalk (*Tate*)=Upper Chalk: Whitehead, near Belfast.

Genus TOULMINIA, *Zittel*, 1877.

TOULMINIA OBLIQUA, *Hinde*, n. sp. (Plate XXIX. figs. 7, 7 *a*, 7 *b*.)

Sponge funnel- or cup-shaped. The only example is 48 mm. in height, and 50 mm. wide at the summit. The cloacal cavity is 20 mm. in width near the upper margin; it appears to be without any definite wall.. The wall is composed of irregularly anastomosing folds about 1 mm. in thickness. The dermal membrane of the summit of the walls has nearly entirely been removed; the spicular mesh of the wall-plait is irregular; the distance between the nodes is ·25 mm.

Distribution. Upper Chalk: South of England (*coll. T. Smith*).

TOULMINIA JURASSICA, *Hinde*, n. sp. (Plate XXX. figs. 1, 1 *a*, 1 *b*.)

Sponge inverted conical in form, with an oblique summit. The single specimen is 63 mm. in height, and 46 in width near the summit. The cloaca appears to be funnel-shaped, and bounded by a definite wall; it is 23 mm. in width at the upper margin. The sponge is composed of anastomosing convolute wall-plaits, 1 mm. in thickness. The spicular mesh of the wall, as seen in a transverse section, is regular in disposition; the nodes are octahedral, and ·25 mm. apart from each other. No dermal membrane has been preserved, probably owing to the weathering of the surface.

This species differs from the preceding in the well-defined character of the cloacal cavity as well as in the disposition of the wall-plaits, as seen in transverse sections.

This form is at present the only representative of the family of the Meandrospongidæ from the Jurassic system.

Distribution. Upper Jura: Randen, Switzerland.

Genus CAMEROSPONGIA, *D'Orbigny*, 1847.

CAMEROSPONGIA SUBROTUNDA, *Mant.* sp. (Plate XXX. fig. 3.)

1822. *Choanites subrotundus,* Mant. Foss. of the South Downs, p. 179, t. 15. f. 2.
1831. *Choanites subrotundus,* Benett, Cat. Org. Rem. Wilts. t. 16. f. 1.
1848. *Cephalites constrictus,* Toulm. Smith, Ann. & Mag. Nat. Hist. vol. i. p. 292, t. 15. f. 1.

Sponges depressed globate in form, growing either singly or in small groups, and not infrequently in a single series of two or three individuals closely attached together. The sponges appear to have been attached by a few divergent rootlets given off laterally; in the compound examples only the first sponge in the series appears to possess the rootlets. Separate individuals vary between 15 and 35 mm. in breadth, and 6 and 13 mm. in height. The upper surface is slightly rounded, oftentimes with a gentle depression towards the centre. The aperture is circular or oval, from 3·5 to 9 mm. in width, with an elevated margin, encircled by a shallow furrow.

Nearly the entire upper surface and sides are covered by the smooth siliceous membrane. The under surface is uneven, with a few circular apertures between the ridges formed by the folded walls. The convoluted wall-plaits of the interior are slender, and composed of a spicular mesh with lantern nodes; the nodes are ·375 mm. apart.

The subglobate form and the social mode of growth distinguish this species from others of the genus.

Distribution. Upper Chalk: Lewes, Sussex; Charing, Kent (*coll. Mantell, T. Smith*). Also from the Spongarian zone of the Chloritic Chalk (*Tate*) = Upper Chalk: Whitehead, near Belfast (*Jermyn-Street Museum*).

CAMEROSPONGIA CAPITATA, *Toulm. Smith*, sp.

1848. *Cephalites capitatus,* T. Smith, Ann. & Mag. Nat. Hist. vol. i. p. 288, t. 14. f. 11.
1878. *Cephalites capitatus,* Quenst. Petref. Bd. 5, p. 498.

Sponges inverted conical in form, supported on a slender cylindrical stem, with divergent rootlets. The summit is gently convex, the margin is subacute. From the summit the body rapidly tapers to the base. The typical specimen is 21 mm. in height by 31 mm. in width; the stem is 11 mm. in length. The summit-aperture is circular, 11·5 mm. in width, its margin is thickened, and slightly elevated.

The smooth enveloping membrane only covers the summit; the sides exhibit a reticulate aspect, formed by wrinkled ridges with circular or irregular interspaces. A subcylindrical or funnel-shaped cloacal cavity extends from the summit to the base, though it does not appear to have possessed a definite boundary wall. The interior wall-plaits are loosely convolute; they are about ·1 mm. thick. The nodes of the spicular mesh are ·45 mm. apart.

This species has a great resemblance in outer form to *C. (Scyphia) fungiformis*, Goldf.*; but the summit is less elevated, and the margins do not project over the sides as in Goldfuss's form. The spicular structure of the mesh is also much larger than in *C. fungiformis*. The description and figures of *C. (Manon) monastoma*, F. A. Rœmer†, are too indefinite to permit of a comparison with the present species. The specimen figured by Rœmer cannot be distinguished from *C. fungiformis*, Goldf.

T. Smith's figure is not an altogether accurate representation of the original, which has a slender stem, and the lateral walls are much closer arranged than represented.

Distribution. Upper Chalk: South of England (*coll. Mantell, T. Smith*).

Camerospongia fungiformis, *Goldf.* sp.

1826–1833. *Scyphia fungiformis*, Goldf. Petref. 1 Th. p. 218, t. 65. f. 4.

1877. *Camerospongia fungiformis*, Zitt. Studien, I Ab. p. 57; Neues Jahrbuch, p. 368.

1878. *Camerospongia fungiformis*, Zitt. Handb. der Pal. p. 182, f. 97.

The Museum only possesses microscopic fragments of the spicular mesh of this species. The disposition of the mesh appears to be regular; the octahedral nodes are ·35 mm. apart: thus the mesh-interspaces are smaller than in *C. capitata*.

Distribution. Upper Chalk: Vordorf, Brunswick.

Camerospongia turbinata, *Giebel*, sp.

1851. *Ptychotrochus turbinatus*, Giebel, Jahresbericht des naturhist. Vereins in Halle, p. 53, t. 2. f. 5.

Microscopic fragments of the spicular mesh.

Distribution. Upper Chalk: Galgenburg, Goslar (*coll. Zitt.*).

Camerospongia campanulata, *T. Smith*, sp.

1848. *Cephalites campanulatus*, T. Smith, pars, Ann. & Mag. Nat. Hist. vol. i. p. 289, t. 14. f. 12, non f. 13.

1877. *Camerospongia campanulata*, Zitt. Studien, I Ab. p. 57; Neues Jahrbuch, p. 368.

1878. *Cephalites campanulatus*, Quenst. Petref. Bd. 5, p. 498.

Sponges subglobate in form, supported on a short cylindrical stem with divergent rootlets. The summit is dome-shaped, with slight elevations and depressions; the central aperture is circular, and about 22 mm. in width. A typical specimen is 42 mm. in height and 54 in width, whilst the stem is only 8 mm. in length.

A wide subcylindrical cloacal cavity, apparently destitute of a boundary wall, extends from the summit to the base. The smooth membrane covers the summit and the sides to nearly two-thirds the height of the sponge. The under surface exhibits the reticulations of the wall-plaits with irregular interspaces. The convolute

* Petrefacten, 1 Th. p. 218, t. 65. f. 4.

† Nordd. Kreide, p. 2, t. 1. f. 8.

walls of the interior are about 1 mm. in thickness; the octahedral nodes of the mesh are ·38 mm. apart.

The larger size and the dome-shaped summit distinguish this species from *C. capitata*; the spicular mesh is also smaller. The figures H and I of T. Smith (*loc. cit.* p. 291), representing the disposition of the folds of the wall, are purely diagrammatic. In the typical examples the wall-plaits do not exhibit the regularly arranged folds depicted in these figures.

Distribution. Upper Chalk: South of England (*coll. T. Smith*).

CAMEROSPONGIA APERTA, *Hinde*, n. sp. (Plate XXX. figs. 2, 2 *a*, 2 *b*.)

1848. *Cephalites campanulatus*, T. Smith, pars, Ann. & Mag. Nat. Hist. vol. i. t. 14. f. 3.

Sponges depressed, cup-shaped, supported on a short stem with diverging rootlets. The interior exhibits a funnel-shaped cloacal cavity, bounded by a definite wall; the margins are subacute. The lateral surfaces are smooth and slightly uneven; the under surface is formed by uneven ridges with irregular interspaces. A few irregularly convoluted wall-plaits are shown in a vertical section; the spicular mesh has a regular disposition; the octahedral nodes are ·25 mm. apart. The spicular mesh of the walls of the cloaca is of the same character as that forming the interior plaits. The body of the type specimen is 25 mm. in height by 36 in width.

This species differs from *C. campanulata*, as defined above, by its generally smaller size, the widely expanded cloacal aperture, the definite cloacal wall, and the smaller dimensions of the spicular mesh.

Distribution. Upper Chalk: South of England (*coll. T. Smith*).

Genus CYSTISPONGIA, *F. A. Rœmer*, 1864.

CYSTISPONGIA BURSA, *Quenst.* sp.

1852. *Cephalites bursa*, Quenst. Handbuch d. Petref. p. 670, t. 60. f. 17.

1864. *Cystispongia bursa*, F. A. Rœmer, Palæontographica, vol. xiii. p. 7, t. 4. f. 7.

1877. *Cystispongia bursa*, Zitt. Studien, I Ab. p. 57; Neues Jahrbuch, p. 368; Handb. d. Pal. p. 182, f. 98.

1878. *Cephalites bursa*, Quenst. Petref. Bd. 5, p. 492, t. 138. f. 17.

Distribution. Obere Pläner: near Vienenburg, Prussia (*coll. Zitt.*).

Family *CALLODICTYONIDÆ*, Zittel.

Genus CALLODICTYON, *Zittel*, 1877.

CALLODICTYON ANGUSTATUM, *Hinde*, n. sp. (Plate XXX. figs. 4, 4 *a*, 4 *b*.)

Sponges elongate, funnel-shaped, very gradually tapering from the summit to the

base. The stem has not been preserved. An imperfect specimen measures 110 mm. in length, and 40 mm. in width at the summit.

The wall of the sponge, about 2 mm. in thickness, is composed of an extremely regular spicular mesh with oblong interspaces; the nodes are octahedral, and about ·6 mm. apart in a vertical direction and ·45 mm. transversely. The outer surface is formed of a very delicate open network, with circular or ovate apertures, ·5 mm. in width, disposed in vertical rows. These apertures open directly into the interspaces of the mesh, and do not appear to be connected with distinct canals. The interior, or cloacal surface of the wall, does not appear to possess a modified spicular mesh.

The examples of this species are preserved in chalk, and the siliceous spicular mesh has been replaced by iron peroxide, so that it is impossible to determine whether the rays were smooth or spinous.

Cylindrospongia membranacea, Quenst.*, non Rœmer, appears to belong to the genus *Callodictyon*, and resembles the present form in the disposition of the apertures of the outer surface; its walls, however, judging from the figure, are not more than one third the thickness of those of *C. angustatum*.

Distribution. Upper Chalk: South of England (*coll. Bowerbank*).

Genus POROCHONIA, *Hinde*, n. g.

Sponges funnel-shaped, with thin walls. The outer surface of the wall is formed by a very delicate membrane, beneath which is a reticulate layer with circular apertures. Below this layer is the regular spicular mesh of the wall; the nodes of the six-rayed spicules are octahedral. The inner or cloacal surface of the wall is formed by a reticulate layer similar to that overlying the spicular mesh. Definite canals do not seem to be present, the circulation being carried on apparently through the regular interspaces of the mesh.

I have based this genus on the characters of *Ventriculites simplex*, T. Smith, the walls of which differ from those of typical forms of *Ventriculites* in being smooth and not arranged in vertical folds. From *Callodictyon* this genus is characterized by possessing a delicate surface-membrane (the polyp-skin of T. Smith) in addition to the usual dermal layer (the underskin of T. Smith). The exterior membrane is only present in some of the best-preserved specimens; and owing to the replacement of its original spicular structure by iron peroxide, the minute characters cannot be determined.

Porochonia simplex, *T. Smith*, sp. (Plate XXX. figs. 5, 5 *a*, 5 *b*.)

1848. *Ventriculites simplex*, T. Smith, Ann. & Mag. Nat. Hist. 2nd ser. vol. i. p. 204, and 1st ser. vol. xx. t. 8. f. 1.

* Petref. Bd. 5, p. 468, t. 137. f. 13.

1851. *Spongia Townsendi,* Morris, Catalogue, p. 31.

1878. *Ventriculites simplex,* Quenst. Petref. Bd. 5, p. 470, t. 137. f. 17.

Sponges funnel-shaped, either supported on a cylindrical stem with divergent rootlets or having rootlets springing from the base of the funnel. Variable in size—from small forms, 22 mm. in height by 30 in width at the summit, to large examples, 95 mm. in height and 92 in width.

The walls are frequently very compressed; in the best-preserved specimens they are from 1·5 to 2 mm. in thickness. The exterior layer is smooth, and sometimes exhibits concentric markings. The dermal layer is perforated with irregularly disposed circular or oval apertures, about ·5 mm. in width, and the same distance apart. The spicular mesh is regularly subquadrate; the octahedral nodes are ·43 mm. apart. The spicular structure of the stem and rootlets differs from that of the walls, and consists of a network of elongate spicular fibres.

The examples of this species are abundant; in all cases the spicular structure is either in the condition of iron peroxide or in hollow casts.

According to T. Smith, *Spongus Townsendi,* Mant.*, is nothing more than a *V. simplex* in flint. If such were certainly the case the specific name of Mantell ought to have been retained; but the type of Mantell, now in the Museum, is so completely imbedded in flint that its spicular characters cannot be ascertained, and it might belong to an entirely different form from Smith's species.

The sponge figured by the late Sir Wyville Thomson, in the 'Depths of the Sea'†, as *Ventriculites simplex,* T. Smith, and from thence copied into other works, has no resemblance to Smith's species, though it may possibly be a genuine specimen of *Ventriculites.*

Distribution. Upper Chalk: Lewes, Sussex; Charing, Kent (*coll. Mantell* and *T. Smith*).

Genus BECKSIA, *Schlüter*, 1868.

BECKSIA SŒKELANDI, *Schlüter.*

1868. *Becksia Sœkelandi,* Schl. Sitzungsb. der nieder. Gesells. im Bonn, p. 93.

1872. *Becksia Sœkelandi,* Schl. Ueber die Spongit.-Baenke des Münsterlandes, p. 20, t. 1. f. 5–7.

1877. *Becksia Sœkelandi,* Zitt. Studien, I Ab. p. 58; Neues Jahrbuch, p. 369.

1878. *Becksia Sœkelandi,* Quenst. Petref. Bd. 5, p. 489, t. 138. f. 14.

1878. *Becksia Sœkelandi,* Zitt. Handb. der Pal. 1 Th. p. 183, f. 99.

Distribution. Upper Chalk: Coesfeld, Westphalia.

* Fossils of the South Downs, p. 154, t. 15. f. 19.

† P. 483, f. 80; p. 484, f. 81.

Genus DIPLODICTYON, *Zittel*, 1877.

DIPLODICTYON HETEROMORPHUM, *Reuss*, sp.

1845. *Scyphia heteromorpha*, Reuss, Böhm. Kreide, p. 74, t. 18. f. 1, 2.
1877. *Diplodictyon heteromorphum*, Zitt. Studien, I Ab. p. 59.

Microscopic fragments of the spicular mesh.

Distribution. Pläner-Kalk: Schilling, Bohemia (*coll. Zitt.*).

DIPLODICTYON BAYFIELDI, *Hinde*, n. sp. (Plate XXXI. figs. 2, 2 *a*.)

Sponge compressed, triangular in outline, apparently supported on a short stem. The walls, 3·8 mm. in thickness, run parallel with each other; their summit-margins are rounded. On the compressed sides are two or three large ovate apertures. The only example is 58 mm. in height and 50 mm. in width at the summit.

The outer surface has numerous circular, irregularly disposed apertures, about 1 mm. in width. The thickness and spicular character of the dermal layer cannot be determined owing to the condition of the specimen. The interior part of the wall is formed of an apparently regular quadrate mesh; the octahedral nodes are ·25 mm. apart.

This species may be distinguished from *D. heteromorphum* by its different form and the smaller dimensions of the mesh-interspaces of the interior of the wall.

I have named this form after its discoverer, Mr. T. G. Bayfield of Norwich.

Distribution. Upper Chalk: Norwich (*coll. Bayfield*).

Genus SCLEROKALIA, *Hinde*, n. g.

Sponges cup- or nest-shaped, with very thick walls. Apparently free. The interior surface of the cup is provided with circular or ovate canal-apertures disposed in vertical rows. The exterior surface has no special canal-apertures. The canals opening into the cloaca do not appear to extend far into the wall. A dermal layer, composed of a thickened reticular mesh with irregular pores, forms the inner surface of the wall; the outer surface does not possess a special dermal layer. The substance of the wall is formed of a robust spicular mesh with octahedral nodes. Near the inner surface the mesh is very regularly disposed, but in the central and outer portions of the wall the arrangement is of a less regular character. There does not appear to be any definite boundary between the regular and irregular mesh; and the spicular rays are of the same thickness, and the nodes octahedral throughout the wall.

The type of this genus is an imperfect example of a nest-shaped sponge preserved in a siliceous matrix. The structure of the interior of the wall has been partly obliterated, so that the character of the canals cannot be ascertained with precision.

The distinctive character of the sponge is the great thickness of the walls, which are composed of a continuous mesh, not arranged in a series of folds as in *Pachyteichisma.* Neither can the walls be differentiated into a relatively thin true wall and a posterior supplemental skeleton as in *Stauronema*, for the only difference between the inner and the deeper portions of the wall consists in a gradual transition from a regular to an irregular disposition of the spicular mesh.

The systematic position of this genus is uncertain. In the characters of the cloacal surface it resembles sponges of the Euretidæ family; but the octahedral nodes and the slight development of the canals exclude it from this group. In some respects the wall-structure resembles that of the genus *Diplodictyon*; and it may provisionally be associated in the same family with this genus.

SCLEROKALIA CUNNINGTONI, *Hinde*, n. sp. (Plate XXXI. figs. 3, 3 *a*, 3 *b*, 3 *c*.)

The only example resembles a bird's nest in form. The walls are thickest in the lower and basal portions, the upper margins are rounded. The specimen is 85 mm. in height and 145 mm. in width. The extreme thickness of the wall is 50 mm. The apertures of the inner surface of the wall are about 1·5 mm. in length and about 2·5 mm. apart. The mesh-interspaces are circular or oval; the nodes are from ·45 to ·5 mm. apart. The pores between the rays forming the spicular nodes are very minute, so that their octahedral characters are not readily perceptible. The spicular arms are about ·12 mm. in thickness.

The spicular mesh is only partially preserved; in some places the rays or arms have been enveloped in a thin pellicle of silica, which, by the subsequent dissolution of the inclosed spicules, forms hollow casts of the mesh.

With this species I have associated the name of Mr. William Cunnington, F.G.S., from whom the Museum has obtained its most valuable examples of sponges from the Chalk and Green Sand of Wiltshire.

Distribution. Upper Green Sand: near Devizes, Wiltshire. The type specimen belongs to the Jermyn-Street Museum.

Family *CŒLOPTYCHIDÆ*, Zittel.

Genus CŒLOPTYCHIUM, *Goldfuss*, 1826–33.

CŒLOPTYCHIUM AGARICOIDES, Goldf. (Plate XXXI. figs. 4, 4 *a*.)

1826–33. *Cœloptychium agaricoides*, Goldf. Petref. 1 Th. p. 31, t. 9. f. 20.
1833. *Cœloptychium agaricoides*, S. Woodward, Geol. of Norfolk, t. 4. f. 19.
1841. *Cœloptychium agaricoides*, F. A. Rœmer, Nordd. Kreide, p. 10, t. 4. f. 5.
1876. *Cœloptychium agaricoides*, Zitt. Ueber Cœloptychium, Abhand. k. bayr. Ak. II Cl. Bd. 12, Ab. 3, p. 59, t. 3. f. 1, 4, 5, 6, 10, 11, 13; t. 4 A.

1877. *Cœloptychium agaricoides,* Zitt. Studien, I Ab. p. 59; Neues Jahrbuch, p. 371.

1878. *Cœloptychium agaricoides,* Zitt. Handbuch der Pal. Bd. 1, p. 184, f. 100.

1878. *Cœloptychium longostium,* Quenst. Petref. Bd. 5, p. 519, t. 140. f. 1, 2.

In addition to very perfect examples of this species from the Upper Chalk of Westphalia, the Museum possesses a small specimen from the Upper Chalk of this country which may be referred to this species, though, as the characters of the under surface are concealed, it is doubtful whether it belongs here or to *C. deciminum.* The specimen in question is without a stem; the body is 50 mm. in width and 8 in thickness. The upper surface is flat with a central depression, the margins are sharp and slightly elevated. The surface is for the most part composed of a coarsely reticulate mesh with radiating bands of a finely punctate character. The interior folds of the wall are about ·9 mm. in thickness.

Distribution. Upper Chalk: Coesfeld, Westphalia; Lemförde, Hanover (*coll. Zitt.*); South of England; Norwich (*S. Woodward*).

Cœloptychium deciminum, *F. A. Rœmer.*

1841. *Cœloptychium deciminum,* Rœmer, Nordd. Kreide, p. 10, t. 4. f. 3.

1865. *Cœloptychium Belfastiense,* Tate, Quart. Journ. Geol. Soc. vol. xxi. p. 43, t. 5. f. 7.

1876. *Cœloptychium deciminum,* Zitt. Abhand. k. bayr. Ak. II Cl. Bd. 12, p. 62, t. 1. f. 6, 7, and t. 3. f. 2.

1877. *Cœloptychium deciminum,* Zitt. Studien, I Ab. p. 59; Neues Jahrbuch, p. 371.

The only example in the collection which I refer to this species is the upper portion of a specimen from the Norwich Chalk, which is 114 mm. in width and 15 in thickness. The upper surface appears to have been flat or gently concave; its minute structure is not shown. On the ridges of the under surface are small circular or oval apertures, 1·2 mm. in width. The folds of the interior of the wall are 1·6 mm. in thickness; they are built up of an extremely regular spicular mesh, with octahedral nodes ·44 mm. apart.

The fragment of a specimen from the indurated chalk of Belfast, named by Tate *Cœloptychium Belfastiense,* appears to me to belong to this species. Only the ridges of the under surface are preserved; these are about 6 mm. in width; they are furnished with small circular oscular apertures 1 mm. in diameter. The spicular structure has been obliterated. The specimen is in the Jermyn-Street Museum.

Distribution. Upper Chalk: Norwich (*coll. Bayfield*); Belfast, Ireland.

Cœloptychium furcatum, *Tate.*

1865. *Cœloptychium furcatum,* Tate, Quart. Journ. Geol. Soc. vol. xxi. t. 5. f. 6.

This species is founded on a fragment of the body of a specimen, showing the ridges of the under surface, which openly bifurcate. A few oval oscular apertures

are present on the ridges. No spicular structure has been preserved; and the specimen is too imperfect for comparison with other species.

Distribution. Spongarian zone of the Chloritic Chalk (*Tate*) = Upper Chalk: Whitehead, near Belfast (*Jermyn-Street Museum*).

CŒLOPTYCHIUM SEEBACHI, *Zitt.*

1876. *Cœloptychium Seebachi*, Zitt. Abhand. k. bay. Ak. II Cl. Bd. 12, p. 68, t. 2. f. 5–7, t. 3. f. 8, 9, and t. 5. f. A.

1878. *Cœloptychium Seebachi*, Quenst. Petref. Bd. 5, p. 521, t. 140. f. 3, 4.

1879. *Cœloptychium Seebachi*, Nicholson, Manual of Pal. vol. i. p. 143, f. 38.

Distribution. Upper Chalk: Lemförde, Hanover.

CŒLOPTYCHIUM SULCIFERUM, *Rœmer*.

1841. *Cœloptychium sulciferum*, F. A. Rœmer, Nordd. Kreide, p. 10, t. 4. f. 4.

1876. *Cœloptychium sulciferum*, Zitt. Abhand. k. bay. Ak. II Cl. Bd. 12, p. 72.

1878. *Cœloptychium percussum*, Quenst. Petref. Bd. 5, p. 512, t. 139. f. 14.

Distribution. Upper Chalk: Coesfeld, Westphalia.

CŒLOPTYCHIUM LOBATUM, *Goldfuss*.

1826–33. *Cœloptychium lobatum*, Goldf. Petref. 1 Th. p. 220, t. 65. f. 11.

1864. *Cœloptychium lobatum*, F. A. Rœmer, Pal. Bd. 13, p. 4, t. 2. f. 12.

1876. *Cœloptychium lobatum*, Zitt. Abhand. k. bay. Ak. II Cl. Bd. 12, p. 73.

1878. *Cœloptychium sexlobatum*, Quenst. Petref. Bd. 5, p. 509, t. 139. f. 13.

Distribution. Upper Chalk: Coesfeld, Westphalia.

Suborder **LYSSAKINA**, *Zittel*.

Family *MONAKIDÆ*, Marshall.

Genus ASTRÆOSPONGIA, *F. Rœmer*, 1854.

ASTRÆOSPONGIA MENISCUS, *F. Rœmer*.

1848. *Blumenbachium meniscus*, F. Rœmer, Leonhard und Bronn's Jahrbuch, p. 680, t. 9. f. 1 *a–c*.

1852. *Astræospongium meniscus*, Bronn's Leth. Geogn. 2 Th. p. 156, t. 5. f. 1 *a–c*.

1860. *Astræospongia meniscus*, F. Rœmer, Die silur. Fauna des westl. Tenn. p. 14, t. 1. f. 6.

1878. *Astræospongium meniscus*, Zittel, Handb. der Pal. Bd. 1, p. 185.

1878. *Astræospongia meniscus*, Quenst. Petref. Bd. 5, p. 557, t. 141. f. 8.

1879. *Astræospongia meniscus*, Nicholson, Manual of Pal. vol. i. p. 135. f. 33 *a*, *b*.

1880. *Astræospongia meniscus*, F. Rœmer, Lethea Pal. 1 Th. p. 314, t. 9. f. 2 *a–c*.

Sponges growing in the form of concavo-convex disks; sessile. Specimens vary

surface numerous hexactinellid spicules apparently detached and irregularly mingled together. Slender monactinellid spicules are also present. The specimen has been treated with acid, and the spicules are now in the condition of iron peroxide. A large spicule is 3 mm. in length. The interior structure of the specimen, owing to its condition, cannot be determined; but it is probably made up of spicules similar to those on the exterior, and as these resemble the detached forms to which I have given the name of *S. cretacea*, I refer this sponge to the same species.

Distribution. Upper Chalk: Horstead, Norfolk; South of England (*coll. Bowerbank*).

Family *POLLAKIDÆ*, Marshall.

Genus HYALOSTELIA, *Zitt.* 1878.

HYALOSTELIA SMITHII, *Young and Young*, sp. (Plate XXXII. figs. 1–1 *g*.)

1876. *Acanthospongia Smithii*, Young and Young, Cat. Western Scottish Fossils, p. 38.

1877. *Hyalonema Smithii*, Young and Young, pars, Ann. & Mag. Nat. Hist. vol. xx. p. 426, t. 14. f. 1–3, 5–12, 14–17.

1877. *Acanthospongia Smithii*, Zitt. Studien, I Ab. p. 60.

1878. *Hyalonema Smithii*, Carter, pars, Ann. & Mag. Nat. Hist. vol. i. p. 129, t. 9. f. 1–9, 12, 13.

This species was constituted by Messrs. Young to include detached spicules of various forms which occur, freely intermingled together, in beds of decayed chert of Carboniferous age in Scotland. Many of these spicules are simple Hexactinellids, that is with six rays at right angles to each other, whilst others have a greater number of rays, though they appear to be but varieties of the Hexactinellid type. Messrs. Young suggested the probability that these various forms of spicules might belong to more than a single species of sponge; and this was shown to be the case by Mr. Carter, who subsequently described a sponge, *Holasterella conferta*, which is composed of some of the abnormal hexactinellid spicules which Messrs. Young had included in *H. Smithii*. I therefore propose to restrict *H. Smithii* to the simple hexactinellid spicules, which are the most abundant forms in the beds at Cunningham Baidland, and to the spicular rods with or without the four anchoring-hooks at their termination. The simple spicules usually have a main axis, which varies from 1·5 to 9 mm. in length; the other axes are generally very unequal, and the rays are frequently inflated, and sometimes reduced to a mere rounded knob. The spicular rods are met with singly or disposed parallel with each other in compressed bundles; they are of indefinite length, and vary from ·3 to 1·5 mm. in diameter. When perfect they terminate in four short, recurved, anchor-like rays. These rods are regarded by Messrs. Young as identical with those described by M'Coy under the

name of *Serpula parallela*, but if such were the case, the sponge ought, by the rule of priority, to retain M'Coy's specific name. I do not think, however, that the spicular rods of *H. Smithii* are similar to those described by M'Coy, which, according to the description, are only ·5 mm. in thickness, whereas the majority of those found in the Scotch beds are much thicker, and reach a maximum thickness of 1·5 mm.

Distribution. Lower Carboniferous: Cunningham Baidland, Dalry, Ayrshire. Presented to the Museum by Dr. J. Millar, F.L.S.

HYALOSTELIA PARALLELA, *M'Coy*, sp.

1844. *Serpula parallela,* M'Coy, Synop. Carb. Foss. Ireland, p. 169, t. 23. f. 30.
1880. *Acestra parallela,* F. Rœmer, Leth. Geogn. 1 Th. p. 318, f. 60.

Straight cylindrical spicular rods, of indefinite length, and from ·2 to ·5 mm. in thickness, disposed parallel with each other so as to form flattened bundles. The surface of the rods is smooth, and the interior canal is usually preserved. The originally siliceous composition has been replaced by calcite. Though no anchor-shaped terminations have yet been discovered in connexion with these rods, there can hardly be a doubt that they are the root-like appendages of hexactinellid sponges.

In addition to specimens from the Lower Carboniferous of Scotland, there is a well-preserved example on a slab of rock, to which no label is attached, but which, from its appearance and the character of the other fossils on it, seems to have been derived from the Trenton Limestone at Ottawa.

Distribution. Trenton Limestone: Ottawa, Canada. Lower Carboniferous: Clitheroe, Scotland.

HYALOSTELIA FASCICULUS, *M'Coy*, sp.

1855. *Pyritonema fasciculus,* M'Coy, Brit. Pal. Fossils, p. 10, t. 1 B. f. 13.

The only example of this species in the Museum is a thin compressed band of spicular rods about 5·5 mm. in width. The rods vary from ·2 to ·5 mm. in thickness; the best-preserved examples show closely-set concentric transverse wrinkles, but in others the surface is quite smooth. The axial canals have not been preserved. The spicules in this specimen are siliceous. The transverse wrinkles distinguish this species from *H. parallela.*

No label is attached to the specimen; but it appears to have been derived from the Llandeilo district of Wales.

HYALOSTELIA FUSIFORMIS, *Hinde.* (Plate XXXI. fig. 7.)

1880. *Hyalostelia fusiformis,* Hinde, Foss. Sponge-Spicules, p. 71, t. 5. f. 12–16.

Free hexactinellid spicules, with an elongated main axis and inflated centre. The

rays are straight or slightly curved. The spicules vary from ·45 to 1·05 mm. in length.

Distribution. Upper Chalk: Horstead, Norfolk.

Genus HOLASTERELLA, *Carter*, 1879.

HOLASTERELLA CONFERTA, *Carter*. (Plate XXXII. figs. 2–2 *f*.)

1879. *Holasterella conferta*, Carter, Ann. & Mag. Nat. Hist. ser. 5, vol. iii. p. 141, t. 21. f. 1–8.

1877. *Hyalonema Smithii*, Young and Young, pars, Ann. & Mag. Nat. Hist. vol. xx. p. 426, t. 14. f. 20, 21, 22.

1878. *Hyalonema Smithii*, Carter, pars, Ann. & Mag. Nat. Hist. vol. i. p. 129, t. 9. f. 11 *a–e*.

Sponge club-shaped, composed of abnormal varieties of hexactinellid spicules. The simplest form is a spicule with five arms or rays at right angles to each other, and the sixth ray at the summit of the vertical axis is replaced by several minute upright or radiating processes. In more complex forms these processes at the summit are elongated, and occasionally bifurcate so as to form a group of radiating rays, which, in some cases, are sufficiently numerous to give the spicule a star-like form. The most abnormal variety is a spicule with a flattened or platter-shaped summit composed of numerous (18 to 25) fusiform, smooth, or tubercled rays, united laterally so as to resemble the petals of a flower. The summit is supported on three or five smooth rays which spring from its under surface. Mr. Carter does not appear to have met with this variety; but in the collection made by Mr. Bennie it occurs *in situ*, associated with the simpler spicules of this species, and it is not improbable that it may have been a modified surface-spicule. There is a great variety in the dimensions of the spicules of this species; the rays vary from ·5 to 2·5 mm. in length.

Distribution. Lower Carboniferous: Law Quarry, near Dalry, Ayrshire. Collected by Mr. James Bennie of Edinburgh.

HOLASTERELLA YOUNGI, *Hinde*, n. sp. (Plate XXXII. figs. 3–3 *d*.)

1877. *Stellate Spicules*, Young and Young, Ann. & Mag. Nat. Hist. ser. 4, vol. xx. p. 420, t. 14. f. 13, 19, 23, 24, 27, 29.

1878. *Hyalonema Smithii* ?, pars, Carter, Ann. & Mag. Nat. Hist. ser. 5, vol. i. p. 129, t. 9. f. 10 *a*, *b*.

I propose this species to include detached spicules consisting of five to seven compressed, straight, or slightly incurved, horizontally extended rays, springing from a common expanded centre, with a single vertical ray beneath. The upper surface of these umbrella-shaped spicules is either smooth or tuberculated. The spicular rays vary from ·4 to 2 mm. in length, and from ·07 to ·7 mm. in width. In the same beds with these detached spicules there are flattened fragments of spicular mesh composed

The spicules have a brownish granular appearance, and their surfaces resemble frosted sugar. In cases where some of the rays are fractured the cavity of the interior canal with a smooth wall is exposed, and the spicule at first sight looks like an outer crust investing a foreign body, which probably gave rise to the suggestion of Mr. J. Young that it might be an incrusting sponge. The spicules of this species are rare, and as they are usually very fragmentary and possess an altogether anomalous appearance, their hexactinellid affinities are not readily recognizable. In the peculiar splitting up of the rays they resemble the complex forms of *Holasterella Wrightii*, but they are almost gigantic in comparison, and do not possess the spiral sculpture distinctive of this species.

The spicules figured have been kindly forwarded to me by Mr. James Bennie, and I have great pleasure in naming the species after him.

Distribution. Lower Carboniferous: Law Quarry, Dalry, Ayrshire.

Incertæ sedis.

Genus AMPHISPONGIA, *Salter*, 1861.

AMPHISPONGIA OBLONGA, *Salter*. (Plate XXXIII. figs. 12, 12 *a*, 12 *b*, 12 *c*, 12 *d*.)

1861. *Amphispongia oblonga*, Salter, Mem. Geol. Survey of Great Britain, 32, Scotland, p. 135, t. 2. f. 3.

1877. *Amphispongia*, Zitt. Studien, I Ab. p. 45, note.

1879. *Amphispongia oblonga*, Nicholson, Manual of Pal. 2nd ed. vol. i. p. 135, f. 33 *c*, *d*.

1880. *Amphispongia*, F. Rœmer, Leth. Geogn. 1 Th. p. 317.

This species occurs as free, compressed, elliptical masses, rounded both at the base and summit, from 30 to 60 mm. in length and from 8 to 23 mm. in width. The thickness is inconsiderable. The lower portion of the sponge, from one-fourth to one-half its entire length, is composed of closely approximated, straight, elongated, conical spicules, about 3 mm. in length, and from ·75 to 1 mm. in width, arranged so that their rounded summits form the outer surface of the sponge, whilst their obtuse points reach to its central axis. The upper portion of the sponge, immediately above the large conical spicules, consists mainly of cruciform spicules closely arranged in a regular manner, so that one spicular axis is parallel to the compressed surface of the sponge, whilst the other axis is at right angles to it. The rays of these spicules are usually straight, from ·6 to ·9 mm. in length, and about ·12 mm. in thickness. In other spicules five rays (that is one ray at right angles to the other four) are present, and possibly some may possess six rays, but from the condition of the specimens the sixth ray, even if originally present, cannot satisfactorily be ascertained. Very minute filiform monaxial spicules are also present mingled with the cruciform spicules; and in one specimen there are indications of an exterior surface-layer of

peculiar arrangement and combination with the relatively large conical spicules of the basal portion present characters so entirely different from those of any other fossil siliceous sponge, that I am unable to assign it to a definite position in this order.

My study of this species has been greatly facilitated by the loan of specimens from Prof. Nicholson, Dr. Traquair, and from the collection of the Geological Survey of Scotland, through the kind permission of Prof. A. Geikie, Director-General of the Survey.

Distribution. Silurian strata of Upper Ludlow age: Pentland Hills, near Edinburgh.

Genus MORTIERA, *De Koninck*, 1842.

Mortiera vertebralis, *De Koninck*.

1842. *Mortiera vertebralis,* De Kon. Anim. foss. carbon. Belg. p. 12, t. B. f. 3.

1846. *Mortiera vertebralis,* Mich. Icon. Zooph. p. 253, t. 59. f. 1 *a*, 1 *b*.

1852. *Mortiera vertebralis,* Milne-Edw. & Haime, Brit. Foss. Corals, p. 209.

1872. *Mortiera vertebralis,* De Koninck, Nouv. Rech. sur les Anim. foss. carbonif. Belg. p. 163, t. 15. f. 9, 9 *a*.

1880. *Mortiera vertebralis,* F. A. Rœmer, Leth. Geogn. 1 Th. p. 322, t. 39. f. 11 *a*, 11 *b*.

Sponges detached, growing in the form of short cylinders with biconcave ends, and presenting a superficial resemblance to the centrum of a fish vertebra. The specimens vary from 8 to 36 mm. in height and from 26 to 35 mm. in diameter. The wall of the sponge is composed of numerous vertical radiating lamellæ, which extend to the centre in the same manner as the septa of a coral. The specimens are now calcareous and the minute structure has been obliterated, but traces of spicules, apparently of a Tetracladine character, can be seen in transverse sections. In one specimen, which has been less exposed to weathering influences, the exterior surface is formed of a layer of elongate acerate spicules, about 4 mm. in length, disposed parallel to the axis of the sponge.

This species was regarded by De Koninck as a coral allied to *Cyclolites*; F. Rœmer placed it with the sponges from the presence of fragmentary spicules after treating specimens with acid. There is no doubt that it is a true sponge, and it probably belongs to the Lithistidæ, though its proper position cannot be determined until the characters of the interior spicules are ascertained. The septate disposition of the wall is not peculiar to this species, for a similar arrangement of the wall-tissues also occurs in the Lithistid sponges *Cnemidiastrum stellatum*, Goldf. sp., *Corallidium diceratinum*, Quenst. sp., and also in sponges of the genus *Seliscothon*, Zitt.

Distribution. Carboniferous Limestone: Tournay, Belgium.

munication to the 'Neues Jahrbuch'*, that they fully proved the position of the Pharetrones amongst Calcareous Sponges.

In the same number of the 'Neues Jahrbuch' just referred to, there appeared a lengthy article by Dr. G. Steinmann † on "Pharetronen-Studien," which professed to be the results of five years' investigation of this group. Steinmann agrees with Zittel as to the originally calcareous nature of the fibre and to its being composed of small simple calcareous bodies, which he states are, in their present fossil condition, imbedded in a calcareous mass, but originally the mass might have been either horny or calcareous. In spite of the strong resemblances which Zittel had discovered between this group of fossils and recent Calcareous sponges, Steinmann concludes that "The Pharetrones are an extinct independent division of the Cœlenterata, whose skeletal structures partly resemble those of Sponges, partly those of Hydrozoa, and in part show completely peculiar characters. A resemblance to their dermal skeleton is only found in septate Corals and Hydrozoa, and the structure of their skeletal fibres can only and solely be compared with that of Alcyonaria" ‡. As, however, within a few months after the publication of the paper the author himself, in a communication to the 'Neues Jahrbuch' §, withdraws his opinions, notwithstanding that they had received the support of Prof. Moseley, it is not worth while to show their inconsistency with a true interpretation of the facts.

In the 'Annals and Magazine of Natural History' for January 1883 ‖, Mr. H. J. Carter published "Further observations on the so-called Farringdon Sponges," in which he acknowledges the relationship of many of the Pharetrones to Calcareous sponges; and he also gives a description and figures in the same paper of a recent calcareous sponge possessing a skeleton of solid vermiculate fibres, composed of large and small three-rayed spicules, thus distinctly similar to the skeleton of the fossil Pharetrones.

Shortly after the appearance of Carter's paper, Dr. Emil von Dunikowski contributed to the 'Palæontographica' ¶ a highly important treatise on "Die Pharetronen aus dem Cenoman von Essen und die systematische Stellung der Pharetronen." The author fully corroborates the facts which I had already recorded ** respecting the spicules of the fibre of these sponges; and he adds the further interesting discovery of traces of interior canals in some of the larger spicules, the supposed absence of which led Steinmann to insist that these forms could not belong to Calcisponges. Dunikowski treats fully of the anatomy of the group, and finds so close a resemblance to that of the recent family of Leucones, Haeckel, that he includes therein the Pharetrones as a subfamily. I am unable to agree with this classification, which is based on the opinion that the original constitution of the skeleton is essentially

* 1882, Bd. 2, p. 204. † *Loc. cit.* p. 139. ‡ *Loc. cit.* p. 188.
§ Neues Jahrbuch, 1883, Bd. 1, p. 79. ‖ 5th ser. vol. ii. p. 20. ¶ Band 29, 1883.
** Annals & Mag. Nat. Hist. 1882, 5th ser. vol. x. p. 185.

similar to that of the recent Leucones, and that its present fibrous character is merely the result of a secondary alteration of the structure due to fossilization, as originally it was neither calcareous nor horny, but consisted simply of spicules imbedded in a mass of parenchym.

To determine the question of the original constitution of the fibrous skeleton of the Pharetrones it is necessary to study the structure in those specimens which have suffered least from the effects of fossilization. In the specimens from Warminster, for example, which have been already referred to, the skeletal fibres have apparently been altered to a very slight degree, and they are wholly composed of spicules in close approximation to each other and as closely interwoven together as the strands of a rope. There is no indication of their having been originally loosely imbedded in a mass of parenchym in the same manner as in recent Leucones, in which, according to Haeckel *, the chief portion of the skeleton, consisting of the entire thickness of the body-wall, is composed of irregularly scattered spicules. A similar structure to that of the Warminster examples is also present in transparent sections of *Sestrostomella* from Vaches Noires. The entire fibre is composed of large and small spicules in intimate contact with each other, and bordering the margins of the fibre there is a definite layer of spicular bodies running parallel to it, thus showing very clearly that the spicular constitution of the fibre is original, and is not due to secondary alteration. It is true that in many specimens the fibre is now only partially composed of spicules imbedded in a transparent ground-mass; but this condition results from a partial dissolution of the spicular components of the fibre. Various stages of this alteration may be traced in a series of specimens: in the best-preserved the fibre is entirely composed of spicules, whilst in those which have been most changed no spicules at all are present, and the fibre is destitute of organic structure. I do not think therefore that Dunikowski's theory of the original similarity of the skeleton of the Pharetrones to that of the recent Leucones can be sustained; and whilst admitting the great resemblance of the individual spicules in these two groups, the fibrous arrangement of the skeleton in the Pharetrones appears to me sufficient grounds for placing the group, as Zittel has done, in an independent family.

A short reference may here be made to the characters of the Dermal layer (Dermalschicht, *Zitt.*; Deckschicht, *Dunik.*) in the Pharetrones, of which two distinct kinds are present. One kind consists of a thin open layer of relatively large four-rayed spicules, disposed on the outer surface of the sponge in such a manner that three of the rays are parallel to the surface, whilst the fourth extends inwardly at right angles to it. It is only under very favourable circumstances that this kind of dermal layer has been preserved, and its absence in the specimens examined by Zittel led him to suppose that it might be a distinguishing peculiarity of the group. It occurs

* Die Kalkschwämme, vol. i. p. 304.

in *Tremacystia* (*Verticillites*) *D'Orbignyi*, H., and *Corynella rugosa*, H., and traces of it are present in some species of *Eudea*, *Eusiphonella*, and *Lymnorea*. The other kind of dermal layer has the appearance of a compact smooth or rugose membrane, resembling in aspect the epitheca of a coral, which envelopes the sides and sometimes the greater part of the surface of the sponge. The structure of this membrane is very rarely preserved; but, according to Dunikowski, it is mainly composed of very irregular three-rayed spicules.

The genera into which Zittel has divided this family are mainly based on differences in form and in the canal-structure, and not primarily, as in the case of the Siliceous sponges, on the spicular characters. This is owing to the fact that in many forms the spicular constituents of the fibres have been completely obliterated by fossilization, and notably is this the case with most of the specimens from Triassic strata; so that an attempt to establish the genera on similarity of minute structure can be, at the best, only partially successful. Where, however, the spicular characters of the type species of a genus can be ascertained, it is desirable to include in it only those sponges with a similar minute structure, and thus constitute the genus on a natural basis. Fossil calcareous sponges, like siliceous forms, very frequently are similar in form and in the canal-structure, whilst the minute components of the fibres, when examined under the microscope, are found to vary very considerably. Dunikowski has proposed to subdivide the family according to the various combinations of uniaxial, three-, and four-rayed spicules, in the same manner as Haeckel has divided the recent Leucones; but I have found it extremely difficult in practice to determine in thin sections whether many spicules are uniaxial or three-rayed forms, and it is equally difficult to decide whether a spicule in which three rays are shown in the section may not have possessed a fourth ray, so that this arrangement appears to me not to be available for fossil sponges.

There are, however, in the Pharetrones which I have examined, some clearly marked types of spicular structure which may be briefly mentioned. In the first of these, which I propose to call the "*Corynella*" type, the fibre is nearly entirely composed of subequal, elongate, filiform, three-rayed spicules, arranged parallel to each other in the direction of the axis of the fibre. In these spicules the basal ray is so slightly developed that in transparent sections they may easily be mistaken for uniaxial forms. Relatively large three- and four-rayed spicules are rarely present in the fibre, though they form, in some species at least, an open dermal layer on the surface of the sponge. This type of spicular structure is well developed in the Cretaceous species of *Corynella* and in *Tremacystia*. In a second type, which may be designated the "*Sestrostomella*" type, the skeletal fibres are built up of relatively large three- and four-rayed spicules disposed in the central portions of the fibre and surrounded by smaller and very irregular forms, which frequently appear as sinuous lines forming the exterior border of the fibre. This structure is characteristic of

1878. *Eudea clavata,* Zitt. Studien, III Ab. p. 27.

1879. *Eudea clavata,* Zitt. Neues Jahrb. p. 22.

In a vertical transparent section of a specimen from Ranville, the fibres, seen under the microscope, are clearly defined from the matrix, but the spicular structure is nearly entirely obliterated; in one instance, however, a three-rayed spicule, of medium size, could be distinctly seen. The fibre is about ·12 mm. in thickness.

Distribution. Middle Jura: Couche à Polypiers—Ranville, Bénouville; Calvados.

Eudea perforata, *Quenst.* sp.

1858. *Spongites perforatus,* Quenst. Der Jura, p. 698, t. 84. f. 26, 27.

1878. *Eudea perforata,* Zitt. Studien, III Ab. p. 27.

1878. *Orispongia perforata,* Quenst. Petref. Bd. 5, p. 195, t. 124. f. 22–28.

1879. *Eudea perforata,* Zitt. Neues Jahrb. p. 22.

The fibre of this species, as seen in a transparent section, is about ·25 mm. in thickness; fragments of relatively large three- or four-rayed spicules can be distinguished in it, but for the most part the minute structure is destroyed. On the summit of some specimens there are traces of a dermal layer of three- or four-rayed spicules.

Distribution. Upper Jura: Randen; Nattheim, Würtemberg.

Eudea globata, *Quenst.* sp.

1878. *Orispongia globata,* Quenst. Petref. Bd. 5, p. 195, t. 124. f. 29–34.

1826–33. *Manon peziza,* Goldf. pars, Petref. 1 Th. t. 34. f. 8 *a.*

1878. *Eudea globata,* Zitt. Studien, III Ab. p. 27.

Distribution. Upper Jura: Nattheim, Würtemberg.

Eudea pisa, *Quenst.* sp.

1878. *Orispongia pisum,* Quenst. Petref. Bd. 5, p. 196, t. 124. f. 35, 36.

1878. *Eudea pisa,* Zitt. Studien, III Ab. p. 27.

Distribution. Upper Jura: Randen.

Eudea hirsuta, *Quenst.* sp.

1878. *Tubispongia hirsuta,* Quenst. Petref. Bd. 5, p. 190, t. 124. f. 16–19.

Distribution. Upper Jura: Randen.

Genus COLOSPONGIA, *Laube*, 1864.

Colospongia dubia, *Münst.* sp.

1841. *Manon dubium,* Münst. Beitr. zur Petref. iv. p. 28. t. 1. f. 11.

1845. *Manon pertusum,* Klipst. Beitr. z. g. Kennt. d. öst. Alpen, p. 282, t. 19. f. 4 *a, b.*

1864. *Verrucospongia submarginata*, Laube, Denks. d. k. Akad. d. Wiss. Bd. 24, p. 237, t. 1. f. 11, 11 *a*.

1878. *Celyphia submarginata*, Zitt. Studien, III Ab. p. 29.

1878. *Testaspongia craniolaris*, Quenst. Petref. Bd. 5, p. 539, t. 140. f. 29, 30.

1882. *Celyphia submarginata*, Steinm. Neues Jahrb. Bd. 2, p. 158, t. 6. f. 6–10, and t. 9. f. 3.

Distribution. Trias: St. Cassian, Tyrol (*coll. Klipstein*).

Genus HIMATELLA, *Zittel*, 1878.

HIMATELLA MILLEPORATA, *Münst.* sp.

1841. *Tragos milleporatum*, Münst. Beitr. iv. p. 29, t. 1. f. 17.

1864. *Lymnoretheles milleporata*, Laube, Denks. d. k. Akad. d. Wiss. Bd. 24, p. 234. t. 1. f. 7 *a*, *b*.

1878. *Himatella milleporata*, Zitt. Studien, III Ab. p. 29.

1878. *Tragos milleporatum*, Quenst. Petref. Bd. 5, p. 538, t. 140. f. 25, 26.

1879. *Himatella milleporata*, Zitt. Neues Jahrb. p. 24.

Distribution. Trias: St. Cassian, Tyrol.

Genus PERONELLA, *Zittel*, 1878.

The definition of this genus by Prof. Zittel is based mainly on the form of the sponge and the absence of any definite canal-system. The minute spicular structure of the fibres is by no means uniform in the various species included in the genus; and Zittel suggested the probable necessity of splitting it up, when a better acquaintance with the spicular structure of the different species would allow of a more natural grouping based on the spicular characters.

Though with respect to the Triassic species no fresh grouping is practicable on account of the complete obliteration of the minute structure of the fibres, yet in the species from Jurassic and Cretaceous strata the fibrous structure is, as a rule, sufficiently well preserved to permit its characters to be defined. It consists of relatively large and medium-sized three- or four-rayed spicules, the rays of which are disposed in the central portion of the fibre, and are surrounded by similar, but smaller, spicules; in some instances the fibre is narrow, and almost exclusively composed of the rays of the larger spicules. The borders of the fibre do not show the sinuous spicules which characterize the genus *Sestrostomella*. I have not found any simple acerate spicules in the fibres.

The above definition will include all the Jurassic species which I have examined, but it will exclude for example *Peronella multidigitata*, Mich. sp., which resembles typical forms of *Peronella* in the absence of definite canals, but its spicular structure is distinctly similar to that of the genus *Corynella*. As, however, the presence or

PERONELLA CLAVARIOIDES, *Lamx.* sp. (Plate XXXIII. figs. 6, 6 *a.*)

1821. *Spongia clavarioides,* Lamx. Exp. méthod. p. 88, t. 84. f. 8-10.
1878. *Peronella clavarioides,* Zitt. Studien, III Ab. p. 32.

In a transverse microscopic section of an example of this species from Ranville, the fibres are clear, well defined, and equally disposed throughout the wall; they vary from ·07 to ·2 mm. in thickness. They are composed of irregular three- and possibly four-rayed spicules, heterogeneously mingled together. It is somewhat difficult, on account of the close arrangement of the spicules in the fibre, to ascertain their dimensions; they appear, however, to be relatively large; a single ray, partially visible, measured ·22 mm. in length and ·036 mm. in thickness.

Distribution. Middle Jura: Couche à Polypiers—Ranville, near Caen.

PERONELLA MAMILLIFERA, *Lamx.* sp. (Plate XXXIII. fig. 3.)

1821. *Spongia mamillifera,* Lamx. Exp. méthod. p. 88, t. 84. f. 11.
1840–47. *Spongia mamillifera,* Mich. Icon. Zooph. p. 113, t. 26. f. 5.
1854. *Spongia mammillifera,* Morris, Cat. Brit. Foss. p. 30.
1878. *Spongites mamillatus,* Quenst. Petref. Bd. 5, p. 340, t. 131. f. 37, 38.
1878. *Peronella mamillifera,* Zitt. Studien, III Ab. p. 32.

Sponges growing in depressed bushy masses, from 26 mm. to 60 mm. in width, and about 32 mm. in height. The individual stems are subcylindrical or mammilliform, from 6 to 8 mm. in diameter; the cloacal aperture at their summits is from 1·5 to 2 mm. in width, and in some instances three or four open furrows radiate from it. The individual stems in some examples are nearly free from each other, whilst in others only the coniform summits are free; in a few instances a corrugated dermal layer is present on the under surface of the sponge.

The interior structure, as seen in a longitudinal section, is composed of narrow, ill-defined fibres, about ·1 mm. in width, which are arranged much closer near the exterior than in the central portion of the stem. The fibres are now very crystalline, and only show traces of three- or four-rayed spicules, with the rays disposed in the central axis of the fibre. The spicular rays are from ·1 to ·2 mm. in length, and about ·03 in width.

Distribution. Middle Jura: Couche à Polypiers—Ranville, L'Amouroux, near Caen (*coll. Tesson*); Mont Terrible. Great Oolite: Hampton Cliff, near Bath (*Morris*).

PERONELLA TENUIS, *Hinde,* n. sp. (Plate XXXIII. figs. 2, 2 *a*, 2 *b.*)

Sponges forming small bushy masses, of slender, cylindrical, bifurcating stems, from 3·5 to 5·5 mm. in thickness, either free or united nearly their entire length. The cloacal aperture is about 1 mm. in width.

1878. *Spongites cylindricus,* Quenst. Petref. Bd. 5, p. 172, t. 123. f. 6, 7, 9–15.
1878. *Peronella cylindrica,* Zitt. Studien, III Ab. p. 32.
1879. *Peronella cylindrica,* Zitt. Neues Jahrb. p. 25, t. 2. f. 4.

A transverse microscopic section of a specimen from Heidenstadt shows clearly marked slender fibres, about ·08 mm. in thickness, composed of relatively large three- or four-rayed spicules, irregularly mingled together. A spicular ray measured ·2 mm. in length and ·02 mm. in thickness. In some cases the spicular rays project beyond the margins of the fibre, though not to the same extent as in the specimen figured by Prof. Zittel in the 'Neues Jahrbuch,' 1879, t. 2. f. 4.

Distribution. Upper Jura: Randen; Heidenstadt, Würtemberg. According to Prof. M'Coy this species also occurs in the Coralline Oolite at Malton, Yorkshire.

PERONELLA RADICIFORMIS, *Quenst.* sp.

1878. *Radicispongia radiciformis,* Quenst. (non Goldf.) Petref. Bd. 5, p. 178, t. 123. f. 16–26.
1878. *Peronella radiciformis,* Zitt. Studien, III Ab. p. 32.

Distribution. Upper Jura: Randen, Switzerland.

PERONELLA MICHELINI, *Etallon,* sp.

1859. *Parendea Michelini,* Etallon, Lethea Brunt. p. 420.
1840–47. *Spongia lagenaria,* Mich. (non Lamx.) Icon. Zooph. p. 114, t. 26. f. 4.

Distribution. Upper Jura: Randen, Switzerland.

PERONELLA NODULOSA, *Quenst.* sp.

1858. *Spongites nodulosus,* Quenst. Der Jura, p. 698, t. 84. f. 24.
1878. *Spongites nodulosus,* Quenst. Petref. Bd. 5, p. 335, t. 131. f. 28–30.
1878. *Peronella nodulosa,* Zitt. Studien, III Ab. p. 32.

Distribution. Upper Jura: Streitberg; Nattheim, Würtemberg.

PERONELLA CLAVATA, *Rœm.* sp.

1839. *Scyphia clavata,* F. A. Rœm. Ver. nordd. Oolit. Nacht. p. 10, t. 17. f. 24.
1864. *Siphonocœlia clavata,* F. A. Rœm. Pal. Bd. 13, p. 29, t. 1. f. 2.
1878. *Peronella clavata,* Zitt. Studien, III Ab. p. 32.

Distribution. Lower Neocomian. Hils-Conglomerate: Berklingen, Brunswick.

PERONELLA TRUNCATA, *From.* sp.

1861. *Siphonocœlia truncata,* From. Cat. raisonné, p. 7, t. 1. f. 3, 3 *a*.

Distribution. Lower Neocomian: Censeau, near Salins. Jura: Berklingen, Brunswick.

specimens allows of a comparison, appears to be similar. Mr. Davey* has referred this form to *Corynella* (*Scyphia*) *multidigitata*, Mich.†, but the fibres are thinner, and the spicular structure is also of a different character.

Distribution. Lower Green Sand: Farringdon, Berkshire.

PERONELLA FLABELLATA, *D'Orbigny*, sp.

1850. *Hippalimus flabellatus*, D'Orbigny, Prodr. de Pal. vol. ii. p. 97.
1861. *Discœlia flabellata*, From. Cat. raisonné, p. 9.
1869. *Discœlia flabellata*, de Loriol, Mon. de l'étage Urgon. p. 66, t. 4. f. 19, 20, 21.
1878. *Peronella flabellata*, Zitt. Studien, III Ab. p. 33.

Sponges consisting of several branching cylindrical stems, from 5 to 7 mm. in diameter, attached laterally so as to form fan-shaped expansions. Cloacal tube about 2 mm. in width.

Distribution. Lower Neocomian: Berklingen, Brunswick.

PERONELLA FURCATA, *Goldf.* sp. (Plate XXXIII. fig. 7.)

1826–33. *Scyphia furcata*, Goldf. Petref. 1 Th. p. 5, t. 2. f. 6.
1840. *Scyphia furcata*, F. A. Rœmer, Nordd. Kreide, p. 5, t. 2. f. 6.
1864. *Polyendostoma furcatum*, F. A. Rœmer, Pal. Bd. 13, p. 39, t. 14. f. 5.
1871. *Epitheles furcata*, Geinitz, Pal. Bd. 20, p. 34, t. 8. f. 7, 8.
1878. *Scyphia furcata*, Quenst. Petref. Bd. 5, p. 349, t. 132. f. 4–6.
1878. *Peronella furcata*, Zitt. Studien, III Ab. p. 33.
1883. *Peronella furcata*, Dunik. Pal. Bd. 29, p. 39, t. 39. f. 3, 4.

The examples of this species in the Museum Collection from Essen are small groups of cylindrical tubes, from 5·5 to 7·5 mm. in diameter, and from 18 to 30 mm. in height, usually springing from an extended base. The tubes generally bifurcate near the basal portion, but they also divide near the summit as well. The cloacal cavity is about 1 mm. in diameter. The lower portion in some specimens shows traces of a compact dermal layer. The fibres are about ·12 mm. in thickness, and closely anastomose together. There are no special apertures on the outer surface. According to Dunikowski the fibres are mainly composed of relatively large three-rayed spicules.

Distribution. Cenomanian: Essen. Upper Green Sand: Warminster.

PERONELLA RAMOSISSIMA, *Dunik.*

1883. *Peronella furcata*, Goldf., var. *ramosissima*, Dunik. Pal. Bd. 29, p. 39, t. 39. f. 6.

Distribution. Cenomanian (Upper Green Sand): Essen.

* Transactions Newbury Field-Club, p. 13.
† Icon. Zooph. p. 217, t. 51. f. 9 *a*, *b*.

the perforated walls of a single layer of fibre, and the similarity in the spicular structure.

TREMACYSTIA D'ORBIGNYI, *Hinde.* (Plate XXXIV. figs. 1, 1 *a*–1 *o*.)

1882. *Verticillites D'Orbignyi,* Hinde, Ann. & Mag. Nat. Hist. 5th ser. vol. x. p. 192, t. 10. f. 1, 2, 7, 8, and t. 11. f. 1–24.

1816. *Alcyonite,* W. Smith, Strata identified, t. 6. f. 12.

1882. *Sphærocœlia Michelini,* Steinm. pars (non Simonowitsch), Neues Jahrbuch, Bd. 2, p. 162, t. 7. f. 4 (non 4 *a*, *b*).

Small club-shaped sponges, from 16 to 23 mm. in height, either simple or with lateral branches; growing singly or in small groups from a common extended base. The individual forms consist of a series, generally four to six in number, of subspherical chambers, from 2 to 4·5 mm. in height and from 4 to 6·5 mm. in width. The summit chamber is conspicuously larger than those beneath, and measures from 6 to 9 mm. in height and from 9 to 14 mm. in width. The floor of each chamber is formed by the depressed dome-shaped roof of the chamber below it, and thus there is only a single partition-wall between the respective chambers. A central cylindrical tube, about 2·25 mm. in diameter, connects the chambers, but I have not been able to ascertain whether it is continuous throughout.

The walls are from ·16 mm. to ·2 mm. in thickness; they are perforated by numerous minute circular or subcircular apertures, about ·25 mm. in width and the same distance apart. The outer surface is smooth. The fibre of the walls is mainly composed of elongated, curved, filiform, three-rayed spicules, disposed generally in the direction of the fibre, parallel with each other, and in close contact. These spicules are from ·15 to ·3 mm. in length, and ·006 mm. in thickness. The basal ray is very slightly developed, and usually appears as a minute projecting knob in the centre of the spicule. The outer surface of the fibres has a dermal layer of three- and four-rayed spicules much stouter and larger than the filiform ones beneath. The longest ray of the largest of these dermal spicules which I have yet met with measures ·3 mm. in length and ·07 mm. in width. There are numerous gradational forms between the dermal and the filiform spicules. I have not seen any simple uniaxial spicules in the fibre.

This species is distinguished from *Tremacystia* (*Thalamopora*) *siphonioides*, Mich., by the spherical form of the chambers and its slightly thinner wall. From *Tremacystia* (*Thalamopora*) *Michelinii*, Simonow.*, it differs in possessing a central siphonal tube, and by the absence of a separate basal floor to each of the chambers. Its form, slender walls, and the circular perforations in them distinguish it from *Tremacystia* (*Verticillopora*) *anastomans*, Mant., and its allied species in the Lower Green Sand.

* Beitr. zur Kennt. der Bry. des Essener Grünsandes, p. 31, t. 1. f. 2 *a*, *b*, *c*.

TREMACYSTIA CRIBROSA, *Goldf.* sp. (Plate XXXIV. figs. 3, 3 *a*, 3 *b*.)

1826–1833. *Ceriopora cribrosa*, Goldf. Petref. 1 Th. p. 36, t. 10. f. 16 *a–c*.

1841. *Thalamopora cribrosa*, F. A. Rœm. Nord. Kreide, p. 21.

1847. *Monticulipora cribrosa*, D'Orbigny, Prod. d. Pal. ii. p. 184.

1871. *Thalamopora cribrosa*, Simonow. Beitr. z. Kennt. der Bry. des Essener Grünsandes, p. 26, t. 1. f. *a–e*.

1875. *Thalamopora cribrosa*, Reuss, Pal. Bd. 20, p. 137, t. 33. f. 11–15.

1882. *Thalamopora cribrosa*, Steinm. Neues Jahrbuch, Bd. 2, p. 167.

1883. *Thalamopora*, Dunik. Die Pharetronen, p. 43.

Sponges growing singly or in small colonies of separate or branching subcylindrical or club-shaped individuals, from 4 to 7 mm. in thickness and up to 27 mm. in height. Each individual consists of a series of cyst-like chambers, about 1·25 mm. in height and 2 mm. in width, disposed round a central cloacal tube, about 2 mm. in diameter, with which each cyst connects by a relatively large aperture. The cloacal tube is continuous throughout the length of the sponge. The summit of each cyst is convex, and forms the floor of the cyst above, so that there is but a single partition-wall between them. The surface of the sponge shows numerous vesicular inflations, which indicate the exterior limits of the separate cysts.

The outer walls and the partitions between the cysts are very delicate, about ·25 mm. in thickness, and perforated by numerous subcircular apertures about ·18 mm. in width. The walls are formed of a single layer of fibre, similar to that of *T. D'Orbignyi.* The only specimen in the Museum is but a fragment of an individual, from which I have not been able to ascertain the minute structure; but Dunikowski states that three-rayed spicules are present in the fibre, and Steinmann asserts that its spicular constitution resembles that of *T. anastomans*, Mant. sp.

This species was placed by Goldfuss, Rœmer, and Simonowitsch amongst the Polyzoa; Reuss regarded it as a Foraminifer, and Steinmann as an Alcyonarian. Dunikowski agrees with me that it is an undoubted sponge, but states that it altogether differs from other Pharetrones in the absence of fibres (Mangel der Faserzüge). I cannot, however, see that the walls of the specimen in the Museum in anywise differ from those of *T. D'Orbignyi* and *T. siphonioides.* They are formed of a single thin layer of fibres; and the main difference between this and the species above named consists in a greater subdivision of the interior chambers of the sponge.

This species is distinguished from *T. vesiculosa*, Mich.*, which has a similar cyst-like arrangement in its interior, by its form and mode of growth.

Distribution. Cenomanian: Essen an der Ruhe, Rhenish Prussia.

* Icon. Zooph. p. 209, t. 53. f. 8.

tures, as in the preceding species. The outer surface is even, or with slight swellings and constrictions.

The walls vary from ·24 to ·4 mm. in thickness; the perforations and the spicular structure of the fibres are the same as in *T. anastomans*.

This species differs from *T. anastomans* in the larger size of the individual sponges, the more delicate walls, and the irregular character of the interior chambers. Its mode of growth differs from that of *T. annulatus*, Keeping, sp.; but as the interior characters of this species are not stated, it is not possible to make a comparison of these features in the two species.

Distribution. Lower Green Sand: Farringdon and Upware.

TREMACYSTIA CLAVATA, *Keeping*, sp. (Plate XXXIV. fig. 6.)

1883. *Verticellites clavatus*, Keeping, Fossils of Upware &c. p. 146.

1869. *Discœlia helvetica*, Loriol, pars, Mon. Foss. de Landeron, p. 65, t. 5. f. 8.

Sponges growing singly or in small colonies. The individual sponges are obconical in form, from 25 to 52 mm. in height, and about 14 mm. in diameter. The partitions between the chambers are nearly horizontal, and about 2·75 mm. apart. The central cloacal tube is continuous, elliptical in section, and about 4 mm. in diameter. It is perforated by a circular series of relatively large apertures, with collar-like projections, which open into each chamber.

The walls are from ·25 to ·5 mm. in thickness; the perforations in them are similar to those of the two preceding species. The form and size of the sponge distinguishes this from all other species of the genus. It is comparatively rare.

Distribution. Lower Green Sand: Farringdon and Upware.

Genus ELASMOCŒLIA, *Rœmer*, 1864.

ELASMOCŒLIA CRASSA, *From.* sp. (Plate XXXIII. fig. 11.)

1861. *Elasmojerea crassa*, From. Cat. raisonné, p. 10, t. 2. f. 10.

1878. *Elasmocœlia crassa*, Zitt. Studien, III Ab. p. 34.

The anastomosing walls of the sponge are from 5 to 6·5 mm. in thickness; a single row of cloacal tubes, about 1·75 mm. in width and the same distance apart, extends the length of the crest of the walls. The fibres of the outer surface are so closely arranged that there are only minute circular pores, about ·16 mm. in width, between them. The fibrous mesh of the interior of the wall is relatively open; the fibres are about ·2 mm. in thickness.

There is but a single example of this species in the Museum; the walls are somewhat thinner than in Fromentel's type, but the differences do not appear to me to be sufficient to constitute a distinct species.

Distribution. Lower Green Sand: Farringdon, Berkshire.

ELASMOCŒLIA FARRINGDONENSIS, *Mant.* sp. (Plate XXXIV. figs. 7, 7 *a*.)

1854. *Tragos Farringdonensis,* Mantell, Medals of Creation, vol. i. p. 229, f. 5.

1874. *Tragos Farringdonensis,* Davey, Transactions Newbury Field-Club, p. 14.

Sponges with vertically compressed, upright, or fan-shaped walls, from 30 to 45 mm. in height and the same in breadth. The flattened summit is from 10 to 17 mm. in width, and exhibits numerous circular canal-apertures, about 1·25 mm. in width, irregularly disposed from one to three diameters apart from each other. The lateral surfaces are smooth, and show irregular pores between the fibres. The canals appear to extend throughout the sponge in a generally vertical direction.

The fibres of the interior form an open anastomosing mesh; they are from ·12 to ·2 mm. in thickness. The minute structure is not very distinctly shown in the section examined; it appears to consist of three- and four-rayed spicules with straight arms: slender filiform spicules of the *Corynella* type are also present.

The general form of this and the following species corresponds with that of sponges of the genus *Oculospongia,* but the absence of a compact dermal layer and the different characters of the spicular mesh separate them from this genus, whilst in the large size and vertical extension of the cloacal tubes they resemble typical forms of *Elasmocœlia.*

Distribution. Lower Green Sand: Farringdon (*coll. John Brown*).

ELASMOCŒLIA MANTELLI, *Hinde,* n. sp. (Plate XXXIV. fig. 8.)

Sponges growing in short, upright, or lobed masses from an expanded base. An average specimen is 22 mm. in height and 31 in breadth. The upper surface is flattened or slightly convex; it is penetrated by the apertures of numerous canals, about 2·25 mm. each in width and about their own diameters apart. The fibres are from ·15 to ·3 mm. in thickness. This species may be distinguished from the preceding by its form and the much larger dimensions of the canals. It appears to be rare.

Distribution. Lower Green Sand: Farringdon.

Genus CONOCŒLIA, *Zittel,* 1878.

CONOCŒLIA CRASSA, *From.* sp.

1861. *Siphonocœlia crassa,* From. Cat. raisonné, p. 7, t. 1. f. 1, 1 *a*.

1878. *Conocœlia crassa,* Zitt. Studien, III Ab. p. 34.

In a vertical transparent section of a specimen from Censeau the fibres exhibit a somewhat similar structure to that of *Sestrostomella*; they are mainly composed of filamentous wavy spicules, so closely arranged in the direction of the fibre that it is impracticable to determine if they are uniaxial or three-rayed forms; in the central

portion of the fibres much larger three- or four-rayed spicules are in places distinctly visible. The fibres vary from ·14 to ·3 mm. in thickness.

Distribution. Lower Neocomian: Censeau, Salins, Jura. Hils-Conglomerate: Berklingen, Brunswick.

CONOCŒLIA CENTROLÆVIS, *Rœm.* sp.

1864. *Limnorea centrolævis,* F. A. Rœm. Pal. Bd. 13, p. 37, t. 1. f. 18.

1878. *Conocœlia centrolævis,* Zitt. Studien, III Ab. p. 34.

Distribution. Lower Neocomian. Hils-Conglomerate; Berklingen, Brunswick.

Genus EUSIPHONELLA, *Zittel,* 1878.

EUSIPHONELLA BRONNII, *Münst.* sp.

1826–33. *Scyphia Bronnii,* Münst. in Goldf. Petref. 1 Th. p. 91, t. 33. f. 9.

1854. *Scyphia Bronnii,* Morris, Cat. Brit. Foss. p. 29.

1859. *Siphonocœlia elegans,* From. Introd. à l'étude des Ep. foss. p. 31, t. 1. f. 7.

1859. *Parendea gracilis,* Etallon, Leth. Brunt. p. 421, t. 58. f. 30.

1878. *Scyphia Bronnii,* Quenst. Petref. Bd. 5, p. 183, t. 124. f. 1–15.

1878. *Eusiphonella Bronni,* Zitt. Studien, III Ab. p. 35; id. Handbuch der Pal. vol. i. p. 191. f. 109.

On the summit of the wall of an example of this species from Nattheim there is a dermal layer of three-rayed spicules; possibly, however, the spicules may be furnished with a fourth ray penetrating into the sponge-wall.

Distribution. Upper Jura: Nattheim, Würtemberg. Great Oolite: Minchinhampton (*Morris*).

EUSIPHONELLA INTERMEDIA, *Münst.* sp.

1826–33. *Scyphia intermedia,* Münst. in Goldf. Petref. 1 Th. p. 92, t. 34. f. 1.

1878. *Scyphia intermedia,* Quenst. Petref. Bd. 5, p. 229, t. 125. f. 55–58.

1878. *Eusiphonella intermedia,* Zitt. Studien, III Ab. p. 35.

Distribution. Upper Jura: Randen; Nattheim.

EUSIPHONELLA PERPLEXA, *Quenst.* sp.

1878. *Scyphia perplexa,* Quenst. Petref. Bd. 5, p. 230, t. 125. f. 59–63.

1878. *Eusiphonella perplexa,* Zitt. Studien, III Ab. p. 35.

Distribution. Upper Jura: Randen.

Genus CORYNELLA, *Zittel,* 1878.

The presence of a canal-system which, according to Prof. Zittel, constitutes the main difference between this genus and *Peronella,* appears to me to be too inconstant

a feature to serve for generic distinction; but the different characters of the spicular structure in the forms referred to these genera afford a more satisfactory basis for separation. Unfortunately, however, this test is inapplicable to the numerous Triassic and Jurassic forms of the genus, the minute structure of which has not, up to the present, been ascertained, and owing to their state of preservation is hardly likely to be known; but if we accept as the type of the genus a Cretaceous species, *Corynella foraminosa*, Goldf. sp., we find that the fibres are composed of minute filiform three-rayed spicules disposed generally parallel with each other in the direction of the fibre. On the outer surface of the sponge there is an open dermal layer of relatively large three- and four-rayed spicules, but these are only seen in specimens which are very favourably preserved. I have not met with any distinctly simple, uniaxial spicules; those which at first sight appear to be such, and which Zittel refers to as simple spicules, I have found to be portions of three-rayed spicules, in which the unpaired or basal ray has but a very slight development.

The inconstancy of the canal-system in sponges of this genus is shown in specimens of *Corynella foraminosa* from the Lower Green Sand at Farringdon. Whilst in some individuals canals are present, in others, precisely similar in all other respects, none are present, or they are restricted to the basal portion of the specimen where the walls are thickest. Again, in *Corynella multidigitata*, Mich. sp., no canals are present, but the spicular structure resembles that of typical species of the genus.

Corynella gracilis, *Münst.* sp.

1841. *Myrmecium gracile,* Münst. Beitr. zur Petref. iv. p. 31, t. 1. f. 26, 27.
1864. *Eudea gracilis,* Laube, pars, Denks. d. k. Akad. d. Wiss. Bd. 24, p. 232, t. 1. f. 3 *a, b.*
1878. *Myrmecium gracile,* Quenst. Petref. Bd. 5, p. 526.
1878. *Corynella gracilis,* Zitt. Studien, III Ab. p. 36.

The fibres of this species, as seen in a transparent section, are from ·1 to ·14 mm. in thickness; in places a few wavy lines can be seen in them, but they are too indistinct for their real characters to be determined.

Distribution. Trias: St. Cassian, Tyrol (*coll. Klipstein*).

Corynella pyriformis, *Klipst.* sp.

1843. *Cnemidium pyriforme,* Klipst. Beitr. z. g. Kennt. d. öst. Alpen, p. 291, t. 20. f. 5.
1864. *Eudea gracilis,* Laube, pars, Denks. d. k. Akad. d. Wiss. Bd. 24, p. 232.
1878. *Corynella pyriformis,* Zitt. Studien, III Ab. p. 36.

Distribution. Trias: St. Cassian, Tyrol (*coll. Klipstein*).

CORYNELLA ROSA, *Laube*, sp.

1864. *Eudea rosa,* Laube, Denks. d. k. Akad. d. Wiss. Bd. 24, p. 232, t. 1. f. 4.
1878. *Corynella rosa,* Zitt. Studien, III Ab. p. 36.

Distribution. Trias: St. Cassian, Tyrol (*coll. Klipstein*).

CORYNELLA ASTROITES, *Münst.* sp.

1841. *Cnemidium astroites,* Münst. Beitr. zur Petref. iv. p. 31, t. 1. f. 24.
1864. *Epitheles astroites,* Laube, Denks. d. k. Akad. d. Wiss. Bd. 24, p. 235.
1878. *Tragos astroites,* Quenst. Petref. Bd. 5, p. 527, t. 140. f. 7–14.
1878. *Corynella astroites,* Zitt. Studien, III Ab. p. 36.

In a transparent microscopic section the fibres appear as well-defined, narrow, anastomosing bands from ·08 to 1 mm. in thickness; beyond traces of wavy lines no spicular structure is discernible.

Distribution. Trias: St. Cassian, Tyrol (*coll. Klipstein*).

CORYNELLA CAPITATA, *Münst.* sp.

1841. *Scyphia capitata,* Münst. Beitr. zur Petref. iv. p. 28, t. 1. f. 12.
1864. *Epitheles capitata,* Laube, Denks. d. k. Akad. d. Wiss. Bd. 24, p. 235, t. 1. f. 8.
1878. *Scyphia capitata,* Quenst. Petref. Bd. 5, p. 526, t. 140. f. 6.
1878. *Corynella capitata,* Zitt. Studien, III Ab. p. 36.

Distribution. Trias: St. Cassian, Tyrol (*coll. Klipstein*).

CORYNELLA LYCOPERDIOIDES, *Lamx.* sp.

1821. *Hallirhoa lycoperdioides,* Lamx. Exp. méthod. p. 72, t. 78. f. 2.
1840–47. *Siphonia lycoperdioides,* Mich. Icon. Zooph. p. 251, t. 58. f. 6.
1878. *Corynella lycoperdioides,* Zitt. Studien, III Ab. p. 36.

Distribution. Middle Jura: Couche à Polypiers—Ranville, Benouville, Caen.

CORYNELLA COSTATA, *Stahl*, sp.

1824. *Alcyonites costata,* Stahl, Correspondenzbl. Würtem. landw. Ver. vi. p. 84, f. 29.
1878. *Spongites astrophorus alatus,* Quenst. Petref. Bd. 5, p. 207, t. 124. f. 54–57.
1878. *Corynella costata,* Zitt. Studien, III Ab. p. 36.

Distribution. Upper Jura: Randen; Giengen, Würtemberg.

CORYNELLA QUENSTEDTI, *Zitt.*

1878. *Corynella Quenstedti,* Zitt. Studien, III Ab. p. 36.
1878. *Spongites astrophorus caloporus* et *cornucopiæ,* Quenst. Petref. Bd. 5, p. 208, t. 124. f. 58–64.

Distribution. Upper Jura: Giengen; Oerlingen; Thurnau, Bavaria.

CORYNELLA ASPERA, *From.* sp.

1864. *Siphonocœlia aspera,* From. Polyp. Corall. de Gray. t. 15. f. 6.
1878. *Corynella aspera,* Zitt. Studien, III Ab. p. 36.

Distribution. Upper Jura.

CORYNELLA MADREPORATA, *Quenst.* sp.

1878. *Madrespongia madreporata,* Quenst. Petref. Bd. 5, p. 212, t. 124. f. 70–72.
1826–33. *Cnemidium astrophorum,* Goldf. pars, Petref. 1 Th. t. 35. f. 8 *b.*
1878. *Corynella madreporata,* Zitt. Studien, III Ab. p. 37.

Distribution. Upper Jura: Nattheim, Würtemberg.

CORYNELLA FORAMINOSA, *Goldf.* sp. (Plate XXXIV. figs. 9, 9 *a*, 9 *b.*)

1826–33. *Scyphia foraminosa,* Goldf. Petref. 1 Th. p. 86, t. 31. f. 4.
1851. *Scyphia foraminosa,* Morris, Cat. Brit. Foss. p. 29.
1854. *Scyphia foraminosa* et *intermedia,* Mant. Medals of Creation, vol. i. p. 227, t. 70. f. 2, 6.
1864. *Endostoma foraminosum,* F. A. Rœmer, Pal. Bd. 13, p. 39, t. 14. f. 6.
1871. *Epitheles foraminosa,* Gein. Pal. Bd. 20, p. 33, t. 8. f. 13.
1874. *Scyphia foraminosa,* Davey, Trans. Newb. Field-Club, p. 13.
1878. *Corynella foraminosa,* Zitt. Studien, III Ab. p. 37.
1883. *Corynella foraminosa,* Dunik. Pal. Bd. 29, t. 39. f. 5.

Sponges growing singly, or occasionally two or three individuals are united near their bases. The individuals are subcylindrical or subconical, usually widest below, and gradually tapering to the summit. The specimens vary from 12 to 50 mm. in height, and from 10 to 21 mm. in width. The walls are from 4 to 9 mm. in thickness, and the cloacal aperture is from 3 to 7 mm. in width.

A compact dermal layer covers the lower portion of the wall in some specimens; where this is not present, the exterior surface shows irregular apertures between the fibres. The interior surface of the cloaca is smooth and perforated with canal-apertures, but in some examples canals are not apparent, or merely present near the basal portion where the walls are thickest.

The anastomosing fibres, as seen in a transparent section of a specimen from the Lower Green Sand at Farringdon, are from ·18 to ·24 mm. in thickness; they are mainly composed of slender, filiform three-rayed spicules, with a few larger forms intermingled. In the section the filiform spicules appear as if uniaxial, but they probably all possess a third minute central ray, similar to the spicules of *C. rugosa.* I have not detected any surface four-rayed spicules in the specimens examined.

This species is very abundant at Farringdon; the examples are usually larger than the forms from the Cenomanian at Essen*.

Distribution. Lower Green Sand: Farringdon, Berkshire. Cenomanian = Upper Green Sand: Essen, Rhenish Prussia.

CORYNELLA TETRAGONA, *Goldf.* sp.

1826–33. ***Scyphia tetragona,*** Goldf. Petref. 1 Th. p. 4, t. 2. f. 2.
1826–33. ***Scyphia mamillaris,*** Goldf. Petref. 1 Th. p. 4, t. 2. f. 1.
1864. ***Endostoma tetragonum,*** F. A. Rœmer, Pal. Bd. 13, p. 39, t. 14. f. 7.
1871. ***Epitheles tetragona,*** Gein. Pal. Bd. 20, p. 33, t. 8. f. 9–12.
1878. ***Scyphia tetragona,*** Quenst. Petref. Bd. 5, p. 352, t. 132. f. 13, 14.
1878. ***Corynella tetragona,*** Zitt. Studien, III Ab. p. 37.
1883. ***Corynella tetragona,*** Dunik. Pal. Bd. 29, p. 36, t. 39. f. 1, 2.

Distribution. Cenomanian: Essen, Rhenish Prussia.

CORYNELLA RUGOSA, *Hinde.* (Plate XXXIV. figs. 10, 10 *a.*)

1882. ***Corynella rugosa,*** Hinde, Ann. & Mag. Nat. Hist. ser. 5, vol. x. p. 196, t. 10. f. 4, and t. 11. f. 25.

Sponges simple, cylindrical, straight or curved, growing from a slender base; the summits truncate. The outer surface has concentric ridges and furrows, or tubercular elevations. An average example is 48 mm. in height and 18 mm. in thickness. The walls are from 4 to 7 mm. in thickness, and the tubular cloaca is 4 mm. wide at its summit.

The outer surface exhibits closely arranged, approximately circular pores formed by the interspaces of the fibre. The fibres are about ·22 mm. in width, and are composed of slender filiform three-rayed spicules, closely disposed parallel with each other in the direction of the fibre. The outer surface is furnished with a dermal layer of larger four-rayed spicules. The spicular structure of this species closely resembles that of *Tremacystia D'Orbigni*, H.

Distribution. Upper Green Sand: Warminster, Wiltshire (*coll. Cunnington*).

* The sponges from Essen, figured by Quenstedt under *C. foraminosa* (Petref. Bd. 5, p. 351, t. 132. f. 8–10), differ very materially from the typical examples of this species, and in fact resemble more nearly some forms of *Elasmostoma* than *Corynella*. They are either simple or compound, subcylindrical or funnel-shaped; the interior surface is smooth and minutely cribrate, with circular, well-defined, closely approximate apertures about ·6 mm. in width. The exterior surface is partially covered with a dermal layer; where this is not present, the naked fibres of the wall are exposed. Unfortunately the spicular structure is quite destroyed in the thin section examined; and therefore I propose to allow these forms to remain under *Corynella* until their minute structure is determined, and to designate the species *C.? cribrata.*

1878. *Spongites rotula,* Quenst. Petref. Bd. 5, p. 234, t. 126. f. 1–41.
1876. *Myrmecium hemisphericum,* Zitt. Studien, III Ab. p. 38.

In a vertical microscopic section of a specimen from Randen the fibres appear as narrow anastomosing bands from ·07 to ·1 mm. in width; the rays of irregular three- or four-rayed spicules can be distinctly seen in the fibres. An average ray measures ·2 mm. in length by ·04 mm. in width.

Distribution. Upper Jura: Heuberg, Nattheim, Thurnau; Heiligenstadt; Basle; Randen.

MYRMECIUM INDUTUM, *Quenst.* sp.

1858. *Spongites indutus,* Quenst. Der Jura, p. 698, t. 84. f. 21, 22.
1878. *Spongites indutus,* Quenst. Petref. Bd. 5, p. 245, t. 126. f. 42–46.
1878. *Myrmecium indutum,* Zitt. Studien, III Ab. p. 38.

Distribution. Upper Jura: Nattheim, Würtemberg.

Genus LYMNOREA, *Lamx.* 1821.

LYMNOREA MAMILLOSA, *Lamx.* (Plate XXXV. figs. 1, 1*a*, 1*b*.)

1821. *Lymnorea mamillosa,* Lamx. Exp. méthod. p. 77, t. 79. f. 2–4.
1878. *Lymnorea mamillosa,* Zitt. Studien, III Ab. p. 39.

Sponges growing in hemispherical or subspherical masses, from 15 to 25 mm. in height and from 20 to 38 mm. in width. The basal portion is enveloped in a concentric, wrinkled, compact dermal layer; in some instances the base is concave. The rounded upper surface is furnished with small conical, more or less projecting, eminences, with a circular aperture, about 1 mm. wide, at the summit of each. In a vertical section there are traces of concentric layers of growth. The canals, in some instances at least, extend irregularly through the sponge.

The fibres closely anastomose; they are about ·12 mm. in width. In the transparent sections which I have examined their structure is largely crystalline, but axial three- or four-rayed spicules, with rays about ·24 mm. in length, are clearly shown. In one specimen the fibres on the summit of the sponge exhibit an open dermal layer of spicules, probably four-rayed, similar to those of *Tremacystia D'Orbignyi.*

Distribution. Middle Jura: Couche à Polypiers—Les Moustiers, Ranville, near Caen. Inferior Oolite (Pea-grit): near Cheltenham.

Genus INOBOLIA, *Hinde,* n. g.

Sponges inverted conical, subspherical, or irregular in form, with convex summits. The lateral surface in perfect specimens is inclosed in a compact wrinkled dermal layer. No special canals appear to be present, and the summit only shows the

irregular interspaces between the fibres. The fibres are mainly composed of relatively large three- and four-rayed spicules, the rays of which are disposed in the axis of the fibre. The dermal layer is composed of minute, apparently three-rayed spicules.

In its spicular structure this genus is allied to *Lymnorea* and some species of *Peronella*; but its mode of growth and the absence of canals readily distinguish it from both of these genera.

INOBOLIA INCLUSA, *Hinde*, n. sp. (Plate XXXV. figs. 2, 2 *a*, 2 *b*.)

The examples of this species are from 20 to 42 mm. in height, and from 27 to 50 mm. in width. The fibres, as seen in a vertical transparent section, vary from ·15 to ·2 mm. in width; they anastomose so as to form a very irregular mesh. Their condition is largely crystalline, so that only the rays of the large axial spicules can be distinguished. A single ray of one of these measured ·24 mm. in length by ·036 in width. In one place the dermal layer, examined by a strong lens, shows numerous minute three-rayed spicules, the rays of which closely intercross each other.

Whilst in the best-preserved examples no traces of canals are to be seen, there are some specimens which show here and there the apertures of tubes resembling those of *Oculospongia*. These tubes, however, have no regular course in the substance of the sponge, and appear to me to result from extraneous sources. The spicular structure of specimens possessing the tubes is similar to that of typical examples of the species. This species is apparently abundant.

Distribution. Inferior Oolite. (Pea Grit) near Cheltenham.

Genus STELLISPONGIA, *D'Orbigny*, 1847.

STELLISPONGIA ROTULARIS, *Münst.* sp.

1841? *Cnemidium rotulare,* Münst. Beitr. zur Petref. iv. p. 31, t. 1. f. 25.
1841. *Cnemidium Manon,* Münst. ib. p. 30, t. 1. f. 20.
1841. *Cnemidium astroites,* Münst. ib. p. 31, t. 1. f. 24.
1864. *Stellispongia Manon,* Laube, Denks. d. k. Akad. d. Wiss. Bd. 24, p. 238, t. 1, f. 15 *a, b, c*.
1878. *Cnemidium rotulare,* Quenst. Petref. Bd. 5, p. 527.
1878. *Stellispongia rotularis,* Zitt. Studien, III Ab. p. 40.

Distribution. Trias: St. Cassian, Tyrol (*coll. Klipstein*).

STELLISPONGIA VARIABILIS, *Münst.* sp.

1841. *Cnemidium variabile,* Münst. Beitr. zur Petref. iv. p. 30, t. 1. f. 21–23.
1841. *Cnemidium turbinatum,* Münst. ib. p. 30, t. 1. f. 19.
1843. *Cnemidium stellare,* Klipst. Beitr. z. g. Kennt. d. öst. Alpen, p. 291, t. 20. f. 6.

1843. *Cnemidium concinnum*, Klipst. ib. p. 292, t. 20. f. 7 *a*, *b*.
1878. *Stellispongia variabilis*, Zitt. Studien, III Ab. p. 40.
1882. *Stellispongia variabilis*, Steinm. Neues Jahrb. Bd. 2, p. 180, t. 9. f. 2.

The fibres, in a transparent microscopic section, appear as well-defined anastomosing bands about ·1 mm. in width; no structure could be distinguished. According to Steinmann they are composed of short, simple, sinuous spicules.

Distribution. Trias: St. Cassian, Tyrol (*coll. Klipstein*).

Stellispongia hybrida, *Münst.* sp.

1841. *Tragos hybridum*, Münst. Beitr. zur Petref. iv. p. 29, t. 1. f. 16.
1878. *Stellispongia hybrida*, Zitt. Studien, III Ab. p. 40.

Distribution. Trias: St. Cassian, Tyrol (*coll. Klipstein*).

Stellispongia stellata, *Lamx.* sp.

1821. *Spongia stellata*, Lamx. Exp. méthod. p. 89, t. 84, f. 13.
1840–47. *Spongia umbellata*, Mich. Icon. Zooph. p. 248, t. 58. f. 1 *a*, *b*.
1851. *Spongia stellata*, Morris, Cat. Brit. Foss. p. 30.
1878. *Stellispongia stellata*, Zitt. Studien, III Ab. p. 40.
1883. Non *Stellispongia stellata*, Dunik. Pal. Bd. 29, p. 38, t. 40. f. 5.

The spicular structure of the fibres of this species is clearly of the *Sestrostomella* type. The fibres are from ·15 to ·24 mm. in thickness, and are composed of relatively large irregular three- and four-rayed spicules, with rays from ·3 to ·53 mm. in length. These spicules occupy the central portions of the fibre, and they are surrounded by smaller sinuous, apparently three-rayed, spicules, which form the exterior borders.

Distribution. Middle Jura: Couche à polypiers—Langrune, Ranville, near Caen (*coll. Tesson*). Great Oolite: Hampton Cliff, near Bath (*Morris*).

Stellispongia corallina, *From.* sp. (Plate XXXV. figs. 3, 3 *a*, 3 *b*.)

1859. *Enaulofungia corallina*, From. Introduc. à l'Etude des Ep. fossiles, p. 48, t. 3. f. 11, 11 *a*.
1859. *Enaulofungia globosa*, From. ibid. t. 4. f. 3.
1840–47. *Cnemidium rotula*, Mich. (non Goldf.) Icon. Zooph. p. 115, t. 26. f. 7.
1859. *Astrospongia corallina*, Etallon, Leth. Brunt. p. 424, t. 59. f. 8, 9.
1878. *Stellispongia corallina*, Zitt. Studien, III Ab. p. 40.

Sponges usually simple, though sometimes two or three individuals are amalgamated together, subspherical, growing apparently free or attached to some other organism. The individuals vary from 9 to 21 mm. in diameter. The summit is generally slightly depressed in the centre, from whence several well-marked open canals, ·6 to 1·25 mm. in width, radiate down the sides.

In a transparent section of a specimen from the Coral Rag at Suffield, in Yorkshire, the fibres appear as narrow, open, anastomosing bands, from ·14 to ·3 mm. in width; they are composed of relatively large three- or four-rayed spicules with an exterior layer of smaller sinuous apparently irregular three-rayed forms.

Distribution. Coral Rag: Lyneham, Wiltshire; Suffield, Yorkshire. Upper Jura: Randen.

STELLISPONGIA GLOMERATA, *Quenst.* sp.

1858. *Spongites glomeratus,* Quenst. Der Jura, p. 695, t. 84. f. 10, 11.
1840–47. *Cnemidium stellatum,* Mich. (non Goldf.) Icon. Zooph. p. 115, t. 26. f. 8.
1859. *Didemospongia Thurmanni,* Etallon, Leth. Brunt. p. 422, t. 59. f. 3.
1859. *Stellispongia pertusa, aperta, hybrida,* et *glomerata,* Etallon, ibid. pp. 423, 424, t. 59. f. 4–7.
1878. *Stellispongia glomerata,* Zitt. Studien, III Ab. p. 40.

In a transverse microscopic section of a specimen from Basle the fibres very openly anastomose; they are about ·28 mm. in width. The minute structure resembles that of *S. corallina.*

Distribution. Upper Jura: Giengen, Würtemberg; Basle.

STELLISPONGIA SEMICINCTA, *Quenst.* sp.

1878. *Spongites semicinctus,* Quenst. Petref. Bd. 5, p. 214, t. 125. f. 2–9.
1878. *Stellispongia semicincta,* Zitt. Studien, III Ab. p. 40.

In the Woodwardian Museum at Cambridge there is an imperfect specimen from the Coral Rag at Scarborough, which, so far as I am able to determine, appears to belong to this species. It had been referred to *Spongia floriceps,* Phill.; but the figure of this species in the 'Geology of Yorkshire,' pl. 3. f. 8, is insufficient for comparison.

Distribution. Upper Jura: Randen; Giengen. Coral Rag: Scarborough, Yorkshire.

Genus SESTROSTOMELLA, *Zittel,* 1878.

SESTROSTOMELLA CRIBRATA, *Quenst.* sp.

1878. *Spongites* (*Nudispongia*) *cribratus,* Quenst. Petref. Bd. 5, p. 220, t. 125. f. 14–18.
1878. *Sestrostomella cribrata,* Zitt. Studien, III Ab. p. 41.

The fibres, as seen in a transparent section, are about ·12 mm. in width; their spicular structure is nearly entirely obliterated.

Distribution. Upper Jura: Randen, Switzerland.

SESTROSTOMELLA RUGOSA, *Hinde*. (Plate XXXV. figs. 4, 4 *a*, 4 *b–d*.)

1882. *Sestrostomella rugosa*, Hinde, Ann. & Mag. Nat. Hist. ser. 5, vol. x. p. 198, t. 10. f. 6, and t. 12. f. 1–15.

Sponges growing in upright bushy masses, consisting of subconical and subcylindrical individuals, about 12 mm. in thickness, united at their bases and occasionally laterally, but free at their summits. The type specimen is 68 mm. in height and 76 mm. in breadth. The lower portion of the sponge is enveloped in a compact rugose dermal membrane. The surface exhibits an irregular open network of coarse fibres. Where a cloacal aperture is present, it is about 2 mm. in width, but the summits of some individuals do not show any distinct aperture; in nearly all, open canals extend from the summit down the sides of the sponge.

The fibres, as seen in a transparent transverse section, vary from ·2 to ·41 mm. in width. They are composed of relatively large, axial or subaxial, three- and four-rayed spicules, the rays of which, in some cases, reach to ·5 mm. in length and ·06 mm. in thickness. These central spicules are surrounded by small and minute irregular three-rayed spicules, which present an appearance of wavy lines closely following the contours of the fibre. These smaller spicules are so closely interwoven together that it is difficult to determine their individual forms; but amongst others there is a very characteristic slender spicule, resembling in form a pitch-fork or tuning fork. The basal ray or the handle is straight and tapering, whilst the paired rays or tines of the fork are subparallel, and frequently one is slightly longer than the other. The longest of these pitch-fork spicules which I have seen measures altogether ·3 mm.

Distribution. Cretaceous. Upper Green Sand?: Vaches Noires, near Havre.

SESTROSTOMELLA CLAVATA, *Hinde*. (Plate XXXV. figs. 5, 5 *a*.)

1882. *Sestrostomella clavata*, Hinde, Ann. & Mag. Nat. Hist. ser. 5, vol. x. p. 201, t. 10. f. 5, and t. 12. f. 16–25.

Sponges growing in bushy masses, consisting of numerous cylindrical individuals, from 8 to 10 mm. in diameter, radiating from a common centre. No pedicel is present, but a small smooth place indicates the spot on which the sponge rested during its growth. The summits are rounded; the cloacal aperture is about 2·5 mm. in width; in some cases only canal-apertures are present at the summit. Straight open canals extend from the summit down the sides.

The minute structure of the fibres of this species is essentially similar to that of the preceding, but it differs in form, mode of growth, and the somewhat more slender dimensions of the fibres. In one part of a thin transverse section the characters of the *exterior* portion of the fibre are clearly exhibited, and it is seen to be made up

of minute irregular three-rayed spicules closely intermingled; amongst these the pitch-fork forms are conspicuous.

Distribution. Cretaceous. Upper Green Sand: Vaches Noires, near Havre.

Genus TRACHYSINIA, *Hinde*, n. g.

Sponges either single or growing in bushy masses. The individual spongites are depressed, cylindrical, with uneven, nodose surfaces; the summits generally inflated. The cloacal tube is subcylindrical, shallow, or extending to some depth; in some instances open radiating canals extend from its margins. The interior canals appear to be but slightly developed, the circulation taking place in the interspaces of the coarse fibrous mesh.

The fibres are composed of relatively large three- and perhaps four-rayed spicules heterogeneously mingled with smaller forms. In some places the rays of the larger spicules are in the axis of the fibre, but this disposition is not so general as in *Sestrostomella.* The margins of the fibre show lines of sinuous spicules as in this last-named genus.

The minute fibrous structure of this genus shows its alliance to *Sestrostomella*, from which it is distinguished by the tubular character of the cloaca and the nodose mode of growth. In general form it resembles *Corynella*, but the spicular structure distinguishes it from the typical forms of this genus. It appears to me not unlikely that the minute structure of some of the Jurassic species of *Corynella*, such as *C. Quenstedti*, Zitt., for example, will be found to correspond with that of the present genus.

TRACHYSINIA ASPERA, *Hinde*, n. sp. (Plate XXXV. figs. 6, 6 *a*, 6 *b*.)

Sponge forming a mass, 60 mm. high by 75 wide, of depressed cylindrical individuals, from 26 to 37 mm. in thickness. The outer surface is very uneven and covered with nodose excrescences. The summits are inflated with occasionally slightly elevated necks to the cloacal apertures, which are from 7 to 12 mm. in width. The surface exhibits irregular apertures between the fibres.

The fibres, as seen in a transverse section, vary from ·14 to ·5 mm. in width; the largest spicular ray observed is ·2 mm. in length by ·04 mm. in width.

Distribution. Middle Jura: Couche à polypiers—Ranville, near Caen (*coll. Tesson*).

TRACHYSINIA SOLITARIA, *Hinde*, n. sp. (Plate XXXVI. fig. 9.)

Sponge simple, with a short cylindrical body supported on a compressed stem. Surface with nodose excrescences. The summit is truncate, slightly concave, the cloaca is shallow, with canals radiating from the margins; it is about 5 mm. wide. The fibres are about ·2 mm. wide. The spicular structure has not been ascertained.

This species differs from the preceding in its simple mode of growth and the more delicate character of the fibres.

Distribution. Middle Jura: Couche à polypiers—Ranville (*coll. Tesson*).

TRACHYSINIA MINOR, *Hinde*, n. sp. (Plate XXXVI. fig. 10.)

Sponges forming small groups of subcylindrical individuals, from 10 to 18 mm. in thickness, frequently united laterally. The outer surface is uneven and perforated with large and small irregular apertures. The summits are usually inflated; the cloacal aperture is from 3 to 5 mm. in width and has several well-marked open canals radiating from its margin. The fibres, as seen in a transverse section, are about ·2 mm. in width; the spicular structure resembles that of *T. aspera*, but in the specimen examined marginal sinuous spicules are not present.

Distribution. Middle Jura: Couche à polypiers—Lebisey; Ranville, near Caen (*coll. Tesson*).

Genus BLASTINIA, *Zittel*, 1878.

BLASTINIA COSTATA, *Goldf.* sp.

1826–33. *Achilleum costatum*, Goldf. Petref. 1 Th. p. 94, t. 34. f. 7.
1878. *Spongites costatus*, Quenst. Petref. Bd. 5, p. 221, t. 125. f. 19–23.
1878. *Blastinia costata*, Zitt. Studien, III Ab. p. 42.

Distribution. Upper Jura: Randen; Nattheim, Würtemberg.

BLASTINIA ALATA, *Quenst.* sp.

1858. *Spongites alatus*, Quenst. Der Jura, p. 699, t. 84. f. 28, 29.
1878. *Spongites alatus*, Quenst. Petref. Bd. 5, p. 222, t. 125. f. 24, 25.
1878. *Blastinia alata*, Zitt. Studien, III Ab. p. 42.

In a vertical microscopic section of a specimen from Nattheim the fibres bounding the circular pores are from ·09 to ·12 mm. in thickness; their structure is, to a great extent, obliterated, but here and there clearly marked portions of three-rayed spicules can be distinguished.

Distribution. Upper Jura: Nattheim, Würtemberg.

Genus SYNOPELLA, *Zittel*, 1878.

SYNOPELLA PULVINARIA, *Goldf.* sp. (Plate XXXVI. fig. 1.)

1826–33. *Manon pulvinarium*, Goldf. pars, Petref. 1 Th. p. 2, t. 29, f. 7 *a*, *b* (non t. 1. f. 6 *a*, *b*).
1864. *Tremospongia pulvinaria*, F. A. Rœmer, Pal. Bd. 13, p. 40, t. 14. f. 8.
1878. *Synopella pulvinaria*, Zitt. Studien, III Ab. p. 43.

The sponges from the Lower Green Sand at Farringdon, which I refer to this

species, are small, hemispherical, or amorphous masses, from 28 to 42 mm. in width and about 26 mm. in height, frequently with a concave base, enveloped in a compact, concentrically wrinkled dermal layer; the rounded upper surface is either smooth or with slight elevations, on which several small canal-apertures are grouped together. The interspaces between the canal-openings only exhibit irregular pores between the fibres. The fibres are from ·15 to ·3 mm. in width. I have not been able to ascertain the spicular structure.

The Farringdon examples are smaller than the specimen figured by Goldfuss from Essen, but in other respects they appear to correspond. The forms from the Maestricht Chalk, also referred by Goldfuss to the same, appear to me to belong to a different species; and as Zittel has applied Goldfuss's name to the Essen forms, I propose to adopt another designation for those from Maestricht.

Distribution. Lower Green Sand: Farringdon, Berkshire.

SYNOPELLA SPHÆRICA, *Mich.* sp.

1840–47. *Lymnorea sphærica,* Mich. Icon. Zooph. p. 216, t. 52. f. 16 *a, b.*
1878. *Synopella sphærica,* Zitt. Studien, III Ab. p. 43.

Distribution. Cenomanian: Essen an der Ruhe.

SYNOPELLA GOLDFUSSI, *Hinde,* n. sp. (Plate XXXVI. fig. 2.)

1826–33. *Manon pulvinarium,* Goldf. pars, Petref. 1 Th. p. 2, t. 1. f. 6 *a, b* (non t. 29. f. 7 *a, b*).

Sponges inversely conical, subcylindrical, flattened, cake-shaped, or laterally compressed, from 8 to 20 mm. in height and from 10 to 19 in width. The base and sides are invested in a compact, concentrically wrinkled dermal layer; the truncate or rounded upper surface has from one to three small groups of canal-apertures, from which several deeply marked open furrows radiate; beyond these the surface exhibits irregular apertures between the fibres. Minute structure unknown.

The radiating canals on the summit, which readily distinguish this from the two preceding species, also give it the appearance of *Stellispongia*, and one can with difficulty decide whether it should be ranged under that or the present genus.

Distribution. Upper Chalk: Maestricht.

Genus OCULOSPONGIA, *From.* 1859.

OCULOSPONGIA BINOCULATA, *Quenst.* sp.

1878. *Spongites binoculatus,* Quenst. Petref. Bd. 5, p. 248, t. 126. f. 59.
1878. *Oculospongia binoculata,* Zitt. Studien, III Ab. p. 43.

Distribution. Upper Jura: Giengen, Nattheim, Würtemberg.

OCULOSPONGIA DILATATA, *Rœm.* sp. (Plate XXXVI. fig. 3.)

1864. *Tremospongia dilatata,* F. A. Rœm. Pal. Bd. 13, p. 40, t. 1. f. 24 *a, b.*
1874. *Oculospongia* (*flabellata* ?), Davey, Transac. Newbury Field Club, p. 11.
1878. *Oculospongia dilatata,* Zitt. Studien, III Ab. p. 43.

Sponges growing in small hemispherical or laterally extended masses, from 15 to 20 mm. in height and 16 to 34 in width. The base is inverted conical, flattened or concave, and invested with a concentrically furrowed and wrinkled dermal layer. The upper surface only exhibits irregular interspaces between the mesh-fibres and irregularly scattered canal-apertures, with complete margins, about 1 mm. in width, which, in the best-preserved specimens, slightly project above the general surface. In a vertical section the fibres appear as so many radiating lines, with transverse connections. Some of the canals extend from the base to the surface, whilst others only reach a short distance into the sponge. The fibres are from ·1 to ·3 mm. in thickness; the spicular structure, as seen in a specimen from Berklingen, is of the *Sestrostomella* type. No structure is shown in examples from Farringdon which I have examined.

Distribution. Lower Green Sand: Farringdon. Hils-Conglomerate: Berklingen, Brunswick.

OCULOSPONGIA TUBULIFERA, *Goldf.* sp.

1826–33. *Manon tubuliferum,* Goldf. sp. Petref. 1 Th. p. 2, t. 1. f. 5.
1878. *Oculospongia tubulifera,* Zitt. Studien, III Ab. p. 43.

The fibres, as seen in a transparent microscopic section, are from ·16 to 3 mm. in thickness; no spicular structure has been preserved.

Distribution. Upper Chalk: Maestricht.

Genus CRISPISPONGIA, *Quenst.* 1878.

CRISPISPONGIA PEZIZOIDES, *Zitt.*

1878. *Crispispongia pezizoides,* Zitt. Studien, III Ab. p. 44.
1826–33. *Manon peziza,* Goldf. pars, Petref. 1 Th. t. 34. f. 8 *b.*

Distribution. Upper Jura: Nattheim, Würtemberg.

CRISPISPONGIA EXPANSA, *Quenst.*

1878. *Crispispongia expansa,* Quenst. Petref. Bd. 5, p. 198, t. 124. f. 38–47.
1878. *Crispispongia expansa,* Zitt. Studien, III Ab. p. 44.

Distribution. Upper Jura: Nattheim.

Genus DIAPLECTIA, *Hinde*, n. g.

Sponges growing in cup-, fan-, or platter-shaped expansions. The walls throughout consist of the fibrous mesh. No canals are present; the surface on both sides of the wall exhibits only irregular interspaces between the fibres. The spicular structure of the fibres resembles that of *Sestrostomella.*

I propose this genus to include *Spongia helvelloides*, Lamx., and some other allied forms which, from their similar mode of growth, have been included by Zittel in the genus *Pharetrospongia*, Sollas; but they possess an entirely different spicular structure from that of the type of this latter genus.

Diaplectia auricula, *Hinde*, n. sp. (Plate XXXVI. figs. 4, 4 *a*.)

Sponges forming fan- or ear-shaped expansions. The type specimen is 30 mm. in height and 50 in width. The wall varies from 5 to 10 mm. in thickness; the margins are obtusely rounded. The fibres are from ·2 to ·4 mm. in thickness; they are made up of relatively large three- and four-rayed spicules in the axis, and smaller sinuous spicules bordering the fibre. Minute pitch-fork spicules, like those of *Sestrostomella,* are also present.

Distribution. Inferior Oolite (Pea Grit): near Cheltenham. Middle Jura: Couche à polypiers; Langrune (*coll. Tesson*).

Diaplectia helvelloides, *Lamx.* sp. (Plate XXXVI. fig. 5.)

1821. *Spongia helvelloides,* Lamx. Exp. méthod. p. 87, t. 84. f. 1–3.
1854. *Spongia helvelloides,* Morris, Cat. Brit. Foss. p. 30.
1878. *Pharetrospongia helvelloides,* Zitt. Studien, III Ab. p. 46.

Cup-shaped sponges supported on a small cylindrical stem. The walls are from 3 to 5 mm. in thickness. The fibres of the outer or under surface of the cup have a generally vertical disposition; they vary from ·14 to ·4 mm. in thickness. The spicular structure resembles that of the preceding species.

This may be distinguished from the preceding species by its form, thinner walls, and the vertical disposition of the fibres of the outer surface.

Distribution. Middle Jura: Couche à polypiers—Langrune, Ranville, near Caen (*coll. Tesson*). Great Oolite: Hampton Cliff, Bath (*Morris*).

Genus ELASMOSTOMA, *From.* 1859.

In the typical species of this genus *E. acutimargo*, F. A. Rœm. (=*E. frondescens,* From.), the spicular structure of the fibres is of the *Sestrostomella* type, consisting of central, relatively large, three- and four-rayed spicules, surrounded by smaller sinuous irregular spicules, also probably three-rayed. A similar spicular structure is shown in *E. Normanianum*, D'Orbig., and *E. consobrinum*, D'Orbig. sp., as well as in some

new species which I have described below. In other forms, however, from the Lower and Upper Green Sand which agree with the typical species of *Elasmostoma* in general form, and in possessing a smooth surface penetrated with large apertures on one surface of the wall, the spicular structure of the fibres more nearly corresponds to the *Corynella* type, and I have therefore separated these into a distinct genus. In some, if not all, of these latter forms distinct canals are present, whereas, according to Zittel, canals are absent in typical species of *Elasmostoma*.

Elasmostoma acutimargo, *Rœm.* sp.

1839. ***Tragos acutimargo,*** F. A. Rœm. Verst. d. Nordd. Oolit. Nachtr. p. 10, t. 17. f. 26.
1859. ***Elasmostoma frondescens,*** From. Introduction, p. 43, t. 3. f. 6, 6 *a*.
1864. ***Elasmostoma acutimargo,*** Rœm. Pal. Bd. 13, p. 45, t. 1. f. 21.
1878. ***Manon peziza,*** Quenst. pars, Petref. Bd. 5, p. 362, t. 132. f. 39.
1878. ***Elasmostoma acutimargo,*** Zitt. Studien, III Ab. p. 44.

Sponges growing in small fan-shaped expansions from 23 to 37 mm. in height and from 24 to 41 mm. in width. The walls are from 2 to 4 mm. in thickness. On the upper or concave surface, though occasionally on the under surface, there is a smooth, apparently compact, dermal layer perforated with circular or irregular apertures from 1·7 to 3 mm. in diameter. On the opposite surface are shown the reticulated fibres, with small, irregular apertures between them. The fibres, as seen in a transverse microscopic section, are from ·17 to ·31 mm. in thickness; the spicular structure is but faintly shown, but it appears to be of the *Sestrostomella* type.

Distribution. Neocomian, Censeau, Jura: Nogerais; Berklingen, Brunswick.

Elasmostoma Normanianum, *D'Orbigny*, sp.

1847. ***Cupulospongia Normaniana,*** D'Orbigny, Prodr. de Pal. vol. ii. p. 188.
1840–47. ***Spongia Peziza,*** Mich. (non Goldf.) Icon. Zooph. p. 143, t. 36. f. 5.
1864. ***Elasmostoma Normanianum,*** F. A. Rœm. Pal. Bd. 13, p. 45, t. 16. f. 6.
1871. ***Elasmostoma Normanianum,*** Gein. Pal. Bd. 20, p. 36, t. 7. f. 7–12.
1878. ***Manon peziza macropora,*** Quenst. Petref. Bd. 5, p. 361, t. 132. f. 35.
1878. ***Elasmostoma Normanianum,*** Zitt. Studien, III Ab. p. 44.
1883. ***Elasmostoma Normanianum,*** Dun. Pal. Bd. 29, p. 41, t. 38. f. 4, 5.

Sponges fan-shaped, or by the coalescence of the margins becoming obliquely cup-shaped. The examples vary from 24 to 51 mm. in width, and from 22 to 42 mm. in height; the walls are from 3 to 5·5 mm. in thickness. One surface of the wall, either the exterior or interior, is smooth, and perforated with circular apertures from 1 to 2 mm. in width, and about the same distance apart from each other; the margins of the apertures slightly project. The opposite surface only shows the irregular interspaces between the fibres. According to Dunikowski, the fibres exhibit relatively large axial three-rayed spicules, characteristic of the *Sestrostomella* type.

spicular structure is distinctly of the *Sestrostomella* type; a single ray of one of the large axial spicules measures ·24 mm.

In its general characters *Manon Peziza*, Goldf. Petref. 1 Th. t. 29. f. 8, resembles this species; but the oscular apertures are uniformly single, and they are closer arranged than in Goldfuss's form.

Distribution. Upper Chalk: Charlton, Bromley, Kent; Sussex.

Elasmostoma crassum, *Hinde*, n. sp. (Plate XXXVI. fig. 7.)

Sponges growing in irregularly folded expansions; the only specimen is imperfect, and measures 76 mm. in width and the same in height. The walls are from 6·5 to 10 mm. in thickness; the inner or upper surface is smooth, and is perforated by circular apertures from 1·6 to 2 mm. in width, and about the same distance apart; their margins are smooth and even. Between the larger apertures are smaller irregular perforations. The under surface resembles that of the last species.

The fibres are from ·13 to ·4 mm. in thickness; in the specimen examined they are entirely crystalline, and no structure has been preserved.

This species may be readily distinguished from the preceding by the much greater thickness of the walls and the larger size of the oscular apertures.

Distribution. Upper Chalk: Bromley, Kent.

Elasmostoma plicatum, *Hinde*, n. sp. (Plate XXXVII. fig. 1.)

Sponges with convolute walls, either fan- or open funnel-shaped. A fairly large specimen is 95 mm. in width and 57 mm. in height. The walls are 4 mm. in thickness. The inner surface has circular apertures 1 mm. wide, and from 1 to 2 mm. apart, with minutely punctate interspaces. The under surface of the wall resembles that of *E. scitulum*, but the fibres are of a more delicate character.

In a thin transverse section the fibres measure about ·17 mm. in width; their spicular structure resembles that of *E. scitulum*, and they are generally narrower, and more evenly disposed than in that species.

This species approaches closely to *E. scitulum*; but the oscular apertures are smaller, and the fibres are less robust.

Distribution. Craie Chloritée: Cap la Hève, near Havre.

Elasmostoma subpeziza, *D'Orb.* sp.

1847. *Cupulospongia subpeziza*, D'Orb. Prodr. de Pal. vol. ii. p. 288.
1826–33. *Manon peziza*, Goldf. pars, Petref. 1 Th. t. 5. f. 1.
1878. *Manon peziza*, Quenst. pars, Petref. Bd. 5, p. 363, t. 132. f. 42, 43.
1878. *Pharetrospongia subpeziza*, Zitt. Studien, III Ab. p. 46.

Sponges small, obliquely cup-shaped; a fairly large example is 19 mm. in height by 17 in width. The walls are from 2 to 2·5 mm. in thickness. The outer surface

is smooth, with minute circular apertures about ·3 mm. in width, and from ·6 to 1 mm. apart; the interspaces are perforated with minute puncta. The inner surface exhibits reticulate fibres so closely disposed that the interspaces can scarcely be distinguished without a lens.

As seen in a microscopic section, the fibres are from ·1 to ·2 mm. in thickness; the spicular structure is very indistinct, but it appears to resemble that of *E. scitulum*.

The form figured by Goldfuss is stated to have been derived from Essen; but, as Geinitz has pointed out, this is an error, and there is no doubt that it came from Maestricht, where these small sponges appear to be fairly abundant.

Distribution. Upper Chalk: Maestricht.

Genus RAPHIDONEMA, *Hinde*, n. g.

Sponges cup- or funnel-shaped, or forming convolute expansions. On one surface of the wall, and in some forms on both, there is a modified dermal layer, either compact or minutely porous. The dermal layer, either on the outer or inner surface of the wall, is perforated with oscular apertures, except in one species in which it has no oscular apertures, though it extends over the canal apertures of the wall. Definite canals are usually present; they penetrate the wall from one or both surfaces, and in some instances extend quite through it.

The fibres are composed of filiform three-rayed spicules similar to those of *Corynella*; the basal ray of the spicules is but very slightly developed, so that in microscopic sections they appear for the most part as simple uniaxial forms. Rarely are larger three-rayed spicules to be seen in the fibres, though such may be present in the dermal layer, the minute structure of which I have not been able to determine.

As already mentioned, this genus resembles *Elasmostoma* in its mode of growth and general structure, but the spicular constitution of the fibres is of a different character, and resembles the *Corynella* type. It also includes some of the species on which Prof. Sollas has based the genus *Catagma*, but the characters assigned to this genus are not sufficiently definite, and its spicular structure, judging from the figures and descriptions, is very different from that of *Raphidonema*, and resembles somewhat that of *Elasmostoma*.

Raphidonema contortum, *Hinde*, n. sp. (Plate XXXVII. figs. 2, 2 *a*, 2 *b*.)

1874. *Manon peziza,* Davey, Trans. Newbury Field-Club, p. 10.

Sponges growing in convolute expansions; the folds of the walls frequently coalesce so as to form intricate masses of considerable size. The sponge is usually attached by its base, not infrequently to a sponge of a different species. A small example is 29 mm. in height by 42 in width, whilst a fairly large specimen is 65 mm. in height by 100 in breadth. The walls are from 4 to 6 mm. in thickness. Both surfaces are, in the best-preserved specimens, smooth, and alike covered with a modified dermal

layer of very closely arranged fibres, finer than those of the substance of the wall; the interspaces between these surface-fibres are hardly visible without a lens. On one surface of this wall, either the upper or under, are minute circular apertures, from ·5 to ·85 mm. in width and from 1 to 3 diameters apart; these apertures are connected with sinuous canals, which extend generally at right angles into the wall.

The fibres of the interior of the wall, measured in a thin section, are from ·2 to ·4 mm. in thickness; the filiform spicules are slender, and closely arranged parallel to each other in the direction of the fibre and round the margins of the canals.

In its mode of growth, and the size of the oscular apertures, this species corresponds with *Elasmostoma consobrinum*, D'Orbig.; but besides the differences in the spicular structure, which of course can only be ascertained in thin sections, the present species is usually larger and the walls are thicker than in the examples of *E. consobrinum* from the Cenomanian at Essen.

Distribution. Lower Green Sand: Farringdon, Berkshire.

Raphidonema porcatum, *Sharpe*, sp. (Plate XXXVII. fig. 3.)

1854. *Manon porcatum,* Sharpe, Quart. Journ. Geol. Soc. vol. x. p. 196, t. 5. f. 2.
1874. *Manon porcatum,* Davey, Trans. Newbury Field-Club, p. 16.
1878. *Catagma porcatum,* Sollas, Ann. & Mag. Nat. Hist. vol. ii. p. 362.
1883. *Catagma porcatum,* Keeping, Foss. of Upware &c. p. 147.

Sponges either cup-shaped or growing in irregularly convolute expansions. The specimens vary from 30 to 70 mm. in height and from 38 to 100 mm. in breadth. The walls are from 4 to 5·5 mm. in thickness. The upper or inner wall-surface has a smooth dermal layer penetrated by numerous, irregularly disposed, circular apertures, about ·85 mm. in width; the interspaces between these are minutely porous. The under or outer surface of the wall is covered with sharply projecting sinuous anastomosing ridges; the fibres of this surface in some examples are finer and closer arranged than those of the interior of the wall, whilst in other specimens there is but little difference between the surface and the interior fibres.

The interior fibres, as seen in a transverse microscopic section, are from ·15 to ·3 mm. in width; the spicular structure resembles that of *R. contortum.* This species is characterized by the peculiar sinuous ridges of the under surface.

Sharpe states that the inner surface of this species is pierced by very numerous ill-defined openings, but the oscular apertures only appear ill-defined when the surface is worn; in perfect specimens they are as clearly marked as in the preceding species.

Distribution. Lower Green Sand: Farringdon; Upware.

Raphidonema pustulatum, *Hinde*, n. sp. (Plate XXXVI. figs. 8, 8 *a*.)

Sponges either shallow cup- or funnel-shaped, or forming convolute expansions.

A small specimen measures 28 mm. in width by 13 in height, whilst a large form is 55 by 42 mm. The walls are from 3·5 to 7 mm. in thickness. One surface of the wall, generally the upper, has a compact dermal layer, perforated by circular apertures, from 1 to 1·6 mm. in width, with well-defined slightly elevated margins. The opposite surface is smooth; the fibres are, in some instances at least, more slender and closer arranged than those of the interior of the wall.

The fibres, measured in a thin section, vary from ·1 to ·35 mm. in width; the spicular structure is similar to that of *R. contortum.*

This species appears to have been referred by Sharpe* to *Manon marginatum,* Phill.; Davey† has also placed it under the same designation, although he questions the identity of Phillips's species from the Upper Chalk with the Farringdon specimens. Mantell‡ has named it *Tragos peziza,* Goldf.

Distribution. Lower Green Sand: Farringdon.

RAPHIDONEMA MACROPORA, *Sharpe*, sp. (Plate XXXVII. fig. 4.)

1854. ***Manon macropora,*** Sharpe, Quart. Journ. Geol. Soc. vol. x. p. 195, t. 5. f. 3, 4.
1848. ***Chenendopora fungiformis*** ?, Mant. (non Lamx.), Wonders of Geology, p. 637.
1874. ***Manon macropora,*** Davey, Trans. Newbury Field-Club, p. 15.
1878. ***Catagma macropora,*** Sollas, Ann. & Mag. Nat. Hist. ser. 5, vol. ii. p. 356, f. 1.
1878. ***Elasmostoma macropora,*** Zitt. Studien, III Ab. p. 44.
1883. ***Elasmostoma acutimargo,*** Keeping (non Rœm.), Fossils of Upware &c. p. 147.

Sponges cup- or funnel-shaped, or forming convolute expansions. A small specimen measures 25 mm. in height by 23 in width, whilst a large example is 100 by 110 mm. The walls vary from 4 to 10 mm. in thickness. The inner or upper surface of the wall is either even, or in some specimens is marked by concentric rounded ridges and shallow furrows. It is furnished with a smooth, apparently compact, dermal layer, which is perforated by circular or ovate apertures, from 1·5 to 3·5 mm. in width, disposed concentrically nearly in contact with each other. Where the interior is ridged, the apertures occur in the intermediate furrows. Small canals open immediately beneath these apertures. The outer surface of the wall is uneven, sometimes with nodose excrescences; only the naked fibres are shown.

In a transverse microscopic section of a specimen from Upware, the fibres appear as closely reticulating bands, from ·13 to ·26 mm. in width. The filiform, sinuous spicules are more robust and less regularly disposed than in *R. contortum.* Though apparently uniaxial, here and there forms can be detected which show the stunted basal ray of three-rayed spicules, and it is probable that the majority of the spicules are irregular three-rayed forms.

* Quart. Journ. Geol. Soc. 1854, vol. x. p. 189.

† Trans. Newbury Field-Club, p. 15.

‡ Wonders of Geology, 6th ed. 1848, vol. ii. p. 636; Medals of Creation 1854, vol. i. p. 229. f. 1.

I have previously compared the structure of this species to that of *Sestrostomella**, but on further examination I find that the fibres of the interior of the wall are built up of filiform spicules, though it is not unlikely that the dermal layer may be composed of relatively large three- or four-rayed forms.

Distribution. Lower Green Sand: Farringdon; Upware.

RAPHIDONEMA STELLATUM, *Goldf.* sp.

1826–33. *Manon stellatum*, Gold. Petref. 1 Th. p. 3, t. 1. f. 9.
1871. *Stellispongia Goldfussiana*, Gein. Pal. Bd. 20, p. 31, t. 6. f. 4–7.
1878. *Manon peziza stellatum*, Quenst. Petref. Bd. 5, p. 361, t. 132. f. 34.
1883. *Elasmostoma stellatum*, Dun. Pal. Bd. 29, p. 40, t. 37. f. 1, 2, 6, and t. 38. f. 1, 2, 3.

Sponges growing in thin expansions or funnel-shaped. The walls are from 2 to nearly 4 mm. in thickness. The oscular apertures are about ·5 mm. wide, and are either on the upper or under surface of the wall. The fibres bordering the apertures have a stellate arrangement. The opposite surface of the wall exhibits an open network of fibres.

As seen in a transverse microscopic section, the fibres are from ·12 to ·25 mm. in width; they are mainly composed of slender, filiform, irregular, three-rayed spicules. The forms which Dunikowski refers to as "Stabnadeln" appear to me to be more probably fragments of three-rayed spicules.

The thin walls and stellate character of the oscular surface readily distinguish this species.

Distribution. Cenomanian: Essen, Rhenish Prussia.

RAPHIDONEMA FARRINGDONENSE, *Sharpe*, sp. (Plate XXXVII. figs. 5, 5 *a*, 5 *b*.)

1864. *Manon Farringdonensis*, Sharpe, Quart. Journ. Geol. Soc. vol. x. p. 196, t. 5. f. 5, 6.
1874. ? *Chenendopora fungiformis*, Davey, Trans. Newbury Field-Club, p. 13.
1878. *Catagma Farringdonense*, Sollas, Ann. & Mag. Nat. Hist. vol. ii. p. 362.
1878. *Pharetrospongia Farringdonensis*, Zitt. Studien, III Ab. p. 46.

Sponges cup- or funnel-shaped, free or attached by a spreading base, generally to other sponges. Very variable in size; a small individual measures 30 mm. in height and width, whilst a large specimen is 90 mm. in height by 120 in width at the summit. The wall varies from 7 to 17 mm. in thickness. The outer surface of the cup is very uneven, and frequently covered with large nodose excrescences. In some examples the fibres of this surface are finer and closer arranged than in the interior; but, as a rule, there is scarcely any differentiation in their character. The interior of the cup has a very varying aspect in different specimens. In some examples it is coarsely fibrous and exhibits ill-defined apertures of numerous canals, about 1 mm. wide, either irregularly distributed or with a partially horizontal arrangement.

* Annals & Mag. Nat. Hist. 5th ser. vol. x. p. 203.

These canal-apertures are sometimes bridged over by the fibres. In other examples a smooth, minutely porous dermal layer, consisting of very delicate, closely reticulating fibres, extends to varying heights in the cup, and covers over the coarser fibres and the canal-apertures. This dermal layer is very variously developed; in some specimens it is limited to the lower portion of the cup or is entirely absent, whilst in others it extends, like a thin film, quite to the margin, so that the interior of the cup is perfectly smooth. The wall itself is perforated by numerous straight or slightly sinuous canals, which run generally at right angles, but occasionally are oblique to the surface.

The fibres vary from ·1 to ·3 mm. in width, and are composed of filiform spicules similar to those of *R. contortum*. In some cases the dwarfed basal ray of the three-rayed spicules can be clearly seen; but, as a rule, this minute ray cannot be detected in microscopic sections, and thus the spicules appear as if uniaxial. Very rarely is a perfect spicule exposed in the section; the entire length of an apparently complete form is ·23 mm.

The presence of minute three-rayed spicules in this and other species of this genus distinctly marks them off from specimens of *Pharetrospongia*, in which only uniaxial spicules have hitherto been discovered.

Distribution. Lower Green Sand: Farringdon, Berkshire. Very abundant.

Genus PHARETROSPONGIA, *Sollas*, 1877.

Professor Sollas has based this genus on the characters of the single species *P. Strahani*, which is principally distinguished by the uniaxial form of the spicules composing its fibres. Prof. Zittel proposed to extend Sollas's definition so as to include in the genus a group of cup- or funnel-shaped sponges having a general resemblance in their mode of growth to *P. Strahani*. As, however, the spicular structure of the fibres of some, if not all, of these sponges differs from that of *P. Strahani*, it seems to me desirable to limit the genus to sponges which can be shown to possess a similar spicular structure to that of the type species.

Pharetrospongia Strahani, *Sollas*. (Plate XXXVII. fig. 6; Plate XXXVIII. fig. 1.)

1877. *Pharetrospongia Strahani*, Sollas, Quart. Journ. Geol. Soc. vol. xxxiii. p. 242, t. 11.
1878. *Pharetrospongia Strahani*, Zitt. Studien, III Ab. p. 45.
1879. *Pharetrospongia Strahani*, Carter, Ann. & Mag. Nat. Hist. ser. 5, vol. iv. p. 432.
1882. *Pharetrospongia Strahani*, Steinm. Neues Jahrb. Bd. 2, p. 129.

Sponges having the form of variously convoluted plates, which sometimes anastomose so as to become funnel-shaped, also occasionally subcylindrical. The walls are from 7 to 13 mm. in thickness. The sponge does not appear to have been attached.

Small cylindrical forms are 47 mm. in length by 15 in thickness, whilst large expanded examples reach the dimensions of 200 mm. in length and the same in width.

The outer surface of the wall is generally uneven and composed of a layer of reticulate fibres, finer than those of the interior; the interspaces between them are small, irregular in distribution, and either subangular or circular. The inner surface of the wall is usually smoother than the outer, the fibres are thicker, and the interspaces larger; in some cases definite circular apertures up to 1·3 mm. in width are present, but generally the apertures are smaller and irregular in form. No definite canals can be distinguished in the walls, even where they attain their greatest thickness. In some instances the fibres have a general disposition in the direction of the length of the sponge, with transverse connections; but, as a rule, no definite arrangement is perceptible.

The fibres are from ·13 to ·35 mm. in thickness; they are composed of minute, straight, or slightly curved, subcylindrical uniaxial spicules, closely arranged parallel with each other in the direction of the length of the fibre. The longest of these spicules which I have succeeded in measuring is ·14 mm. and its thickness about ·01 mm.

This species occurs in the Cambridge Green Sand, and it is also very abundant in the Upper Chalk. The Chalk examples are for the most part larger and the walls are thicker than in the Green Sand forms, but the differences do not appear to me to be of specific value. Many of the examples from the Green Sand near Cambridge are entirely calcareous, and the fibres completely dissolve when treated with acid; in others the fibres have a thin surface-pellicle of silica and the interior is calcareous. Attached to the siliceous pellicle are entire and fragmentary spicules which have been replaced by silica, the spicules of the interior of the fibre retaining their calcareous composition. A similar replacement has also taken place in some of the forms from the Upper Chalk. Those which are imbedded in the chalk itself have a smooth, waxy aspect, and when treated with acid completely dissolve; but not infrequently specimens are imbedded in flint, and in these cases the exterior portion of the fibres becomes siliceous whilst the interior retains its calcareous condition. That this partial silicification of the fibre is owing to its being surrounded by the flint is clearly shown by the fact that some sponges are partly imbedded in flint and partly in chalk, and only the portion in the flint has been replaced by a thin coating of silica, that in the chalk being wholly calcareous.

By Prof. Sollas and Mr. Carter these sponges are believed to have been originally siliceous, and, from the form and disposition of the spicules in their fibres, to be allied to an existing species of *Reniera*. My reasons for regarding them as originally calcareous are based upon the fact that in their general characters and structure they closely resemble other Pharetrones occurring in the same strata, which by

Mr. Carter (though not by Prof. Sollas) are acknowledged to be calcareous sponges, whilst their condition is altogether different from that of the undisputed siliceous sponges in the same beds. As, however, some of the siliceous sponges from the Cambridge Green Sand are probably derived from other deposits, the dissimilarity existing between them and the specimens of *Pharetrospongia* may be alleged to be owing to the different conditions to which they have respectively been exposed; but the argument is quite applicable to the examples from the Upper Chalk; and if there are important differences in the character and mineral structure of examples of *Pharetrospongia*, and of undisputed siliceous sponges from the same beds and the same localities, they may reasonably be supposed to be due to differences in their original condition. Thus, for example, specimens of the calcareous sponges *Elasmostoma scitulum* and *Pharetrospongia Strahani*, from the Upper Chalk at Bromley in Kent, alike retain the perfect form and calcareous structure of their component fibres; but in the undoubtedly siliceous sponges in the same beds and locality, such as *Ventriculites* or *Scyphia*, the fibres or mesh, instead of being perfectly smooth and calcareous, as in the first-named forms, have been either completely dissolved, leaving empty moulds, or else replaced by powdery iron peroxide. It is impossible to explain these notable differences without supposing that the mineral structure of these sponges was originally different, and it seems therefore reasonable to conclude that the forms with the calcareous fibres retain their original constitution. Mr. Carter readily acknowledges that *Elasmostoma scitulum* is a calcisponge; and *Pharetrospongia Strahani* so closely resembles it in general structure that, notwithstanding the different form of its component spicules, there can hardly be a doubt of its calcareous origin.

Distribution. Upper Green Sand: Warminster, near Cambridge. Upper Chalk: Charlton, Bromley, Broadstairs, Kent; Ditchhampton, near Wilton, Norwich; Pertwood, near Warminster.

Genus PACHYTILODIA, *Zittel*, 1878.

PACHYTILODIA INFUNDIBULIFORMIS, *Goldf.* sp.

1826–33. *Scyphia infundibuliformis*, Goldf. Petref. 1 Th. p. 12, t. 5. f. 2.
1874. *Cupulospongia infundibuliformis*, Gein. Pal. Bd. 20, p. 29, t. 4. f. 4, 5.
1878. *Scyphia infundibuliformis*, Quenst. Petref. Bd. 5, p. 347, t. 132. f. 1–3.
1878. *Pachytilodia infundibuliformis*, Zitt. Studien, III Ab. p. 46.
1883. *Pachytilodia infundibuliformis*, Dun. Pal. Bd. 29, p. 42, t. 40. f. 1, 2.

Sponges cup- or vase-shaped, supported on thickened nodose stems, occasionally forming convolute extensions. An imperfect specimen measures 140 mm. in height by 170 in width. The walls are from 8 to 25 mm. in thickness; the interspaces between the fibres are relatively large. The fibres are from ·4 to ·9 mm. in thickness;

according to Dunikowski they are composed of small uniaxial spicules associated with large three-rayed forms.

Distribution. Upper Green Sand: Warminster. Cenomanian: Essen.

Family *SYCONES*, Haeckel.

Genus PROTOSYCON, *Zittel*, 1878.

PROTOSYCON PUNCTATUM, *Goldf.* sp. (Plate XXXVIII. figs. 2, 2 *a–e*.)

1826–33. *Scyphia punctata*, Goldf. Petref. 1 Th. p. 10, t. 3. f. 10.
1858. *Scyphia punctata*, Quenst. Der Jura, p. 667, t. 81. f. 79.
1870. *Scyphia punctata*, O. Schmidt, Spongien-Fauna des atlant. Gebietes, p. 20, t. 2, f. 21.
1878. *Scyphia punctata*, Quenst. Petref. p. 333, t. 131. t. 21–27.
1878. *Protosycon punctatum*, Zitt. Studien, III Ab. p. 48, t. 12. f. 7.
1879. *Protosycon punctatum*, Zitt. Neues Jahrb. p. 33, t. 2. f. 7.
1883. *Protosycon punctatum*, Carter, Ann. & Mag. Nat. Hist. ser. 5, vol. xi. p. 34.

Small subcylindrical sponges with truncated summits, and occasionally slightly expanded bases. The usual dimensions are from 6 to 14 mm. in length, and from 2·5 to 4 mm. in thickness; an unusually long form, figured by Quenstedt, measures 24 by 3·5 mm. A funnel-shaped cloaca extends quite to the base of the sponge. The walls are from ·7 to 1 mm. in thickness. The outer surface is apparently quite smooth, but under a strong lens delicate vertical furrows are visible. In each of these furrows is a row of minute circular or ovate canal-apertures, and still smaller circular or subangular apertures are wedged in on the intervening ridges. The interior surface of the cloaca is not exposed in the specimens which I have examined; but according to Quenstedt the canal-apertures are disposed in regular vertical and horizontal series.

In a thin vertical median section the walls exhibit a series of horizontal canals, about ·17 mm. in width, some of which are apparently open throughout, while others seem to be closed either at one or both ends. These canals are bounded by three- and four-rayed spicules, and sections of the spicular rays are clearly shown, though the disposition of the spicules cannot be satisfactorily ascertained from a thin section. In some instances the rays are arranged singly, whilst in others the rays of two or three spicules are in close juxtaposition, but they are not apparently united into fibres as in the *Pharetrones*. The spicular rays are about ·04 mm. in thickness; I have not been able to determine their length.

Distribution. Upper Jura: Streitberg, Franconia.

Incertæ sedis.

Genus BACTRONELLA, *Hinde*, n. g.

Sponges simple, rod- or club-shaped, usually attached by a slightly expanded base. The lower portion exhibits traces of a wrinkled compact dermal layer; the rest of the surface is smooth and covered with minute circular and subangular apertures, which appear to be bounded by a delicate open dermal layer of three- or four-rayed spicules. The sponge appears to be throughout composed of spicules, not arranged in fibres, but forming an open tissue with irregular interspaces. The exterior portion is penetrated by definite cylindrical canals which can be traced for a short distance into the interior, though they do not appear to extend into the central portion of the sponge. The spicules are so closely intermingled in the exterior portion that only circular sections of the rays, and rarely a portion of a conical ray, can be distinguished; but in the central portion the spicules are less intricately associated, and definite three- and probably four-rayed forms can be distinguished. The rays of some of these spicules are clearly microspined. Mingled with the definite spicules are smaller forms which appear to be of an irregular character, though the condition of the specimen prevents accurate determination. In transverse sections the interior portion of the sponge is partially filled with a dark earthy matrix, and appears to possess a different structure to the exterior, but this is probably owing to the more compact agglomeration of the spicules near the surface.

This genus is based on the characters of the small Jurassic sponges which form part of Goldfuss's species *Ceriopora clavata*, Petref. 1 Th. p. 36, t. 10. f. 15 *c–f* (non f. *a*, *b*). The minute structure of these forms can only partially be made out in thin microscopic sections, but sufficient is shown to indicate that it materially differs from that of the fossil Calcareous sponges already described. The absence of a fibrous arrangement of the spicules distinguishes it from the *Pharetrones*; whilst the structure of the wall and the absence of a central cloaca separates it from the *Sycones*. The disposition of the spicules more nearly resembles that of the recent *Leucones*; but in none of the existing examples of this family are the three-rayed spicules microspined. As the genus cannot suitably be included in any of the present divisions of the Calcareous sponges, I propose to leave it in an indefinite position until its characters are more clearly ascertained.

Bactronella pusillum, *Hinde*, n. sp. (Plate XXXVIII. figs. 3, 3 *a–g*.)

1826–33. *Ceriopora clavata*, Goldf. pars, Petref. 1 Th. p. 36, t. 10. f. 15 *c–f* (non f. *a*, *b*).
1858. *Ceriopora clavata*, Quenst. Der Jura, p. 665, t. 81. f. 59, 60.
1881. *Ceriopora clavata*, Quenst. Petref. Bd. 6, p. 245, t. 152. f. 63–88.

Subcylindrical or slightly inflated sponges, with conical summits, varying from 3·5

to 10 mm. in length and from 2 to 3·5 mm. in thickness. The canals opening on the outer surface are from ·18 to ·2 mm. in width; they can only be traced for a distance of about ·5 mm., where they appear to terminate in the interior spicular tissues. The spicular rays are conical, acutely pointed, and occasionally with minutely spinous surfaces. The longest measured is ·14 mm. In cross section the rays are circular, with a maximum thickness of ·035 mm. The specimens throughout are calcareous.

Distribution. Upper Jura: probably from Thurnau, Bavaria.

SUPPLEMENT.

SINCE the first part of the work was in type fresh additions have been made to the Museum Collection, including some new species, the descriptions of which, as they could not be inserted in their proper systematic position, are here appended.

Division I. SILICEOUS SPONGES.

Order MONACTINELLIDÆ.

Genus HAPLISTION, *Young and Young*, 1877.

HAPLISTION FRACTUM, *Hinde*, n. sp. (Plate XXXVIII. figs. 4, 4*a*.)

In the fine collection of detached sponge-spicules which Mr. James Bennie very generously forwarded to me for examination, I found several small fragments of a fibrous sponge, resembling, as regards their siliceous condition, the spicules of the Hexactinellid sponges associated with them. The largest of these fragments only measures 5 mm. in length and thickness; it consists of irregularly anastomosing cylindrical fibres from ·14 to ·5 mm. in thickness, which form an uneven meshwork with circular or elongated interspaces about ·6 mm. in width. The fibres appear in fractured surfaces to be solid throughout, and the interior portion only exhibits a fine granular structure. The outer surface, on the other hand, is covered with a layer of simple spicules, which, though generally arranged in the direction of the fibre, are not parallel with each other. The spicules, when examined under the microscope, present uneven, ill-defined outlines, but they appear to have the form of fusiform acerates. The longest measured is ·32 mm. in length by ·03 mm. in width. Whether their surfaces were primarily smooth or spinous it is impossible to determine.

There can scarcely be a doubt that the fibres were originally built up throughout of spicules similar to those which are now exposed on their exterior surfaces, and that by fossilization the interior spicules have been undistinguishably fused together. Their resemblance in mineral condition to the spicules of undoubted siliceous sponges in the same deposit points to the conclusion that they were also originally siliceous.

I have placed these fragments with some doubt under the genus *Haplistion*, for the type of the genus, *H. Armstrongi*, Y. and Y.*, though possessing a fibrous structure generally similar to these fragments, does not show any traces of spicules, and its minute structure is therefore at present doubtful. Through the kindness of Mr. John Young I have been able to examine a fragment of *H. Armstrongi*; and its fibres, independently of the absence of the spicules, appear to me to be of a more robust character than those of the present species.

Mr. H. J. Carter has also described a sponge from the same deposits under the name of *Raphidistia vermiculata*†, which is probably allied to the present species. Judging from the description and figures, *R. vermiculata* is a fibrous sponge composed of fusiform acerates of a sinuous form. Mr. Carter, however, regards the fibres as belonging to a species of *Hydractinia*, and the sponge-spicules as parasitic on the fibres. This view appears to me to be untenable; and Mr. Carter himself suggests that the fibres might probably belong to the sponge. The sinuous form of the spicules distinguishes this species from *H. fractum*.

Distribution. Lower Carboniferous: Law Quarry, Dalry, Ayrshire. Collected by Mr. James Bennie.

Order TETRACTINELLIDÆ, *O. Schmidt.*

Genus GEODIA, *Lamx.*

GEODIA? ANTIQUA, *Hinde*, n. sp. (Plate XXXVIII. figs. 5, 5 *a–e*.)

Detached trifid spicules, with elongated cylindrical or subcylindrical shafts, from ·2 to ·3 mm. in width, and with simple, short, obtusely-pointed head-rays, which project upwards at an acute angle with the head of the shaft. The shafts are all incomplete; the longest preserved is 2 mm. in length, and it is of the same thickness at the end as at the summit. Associated with the trifid spicules are curved acerates of somewhat similar dimensions, which may probably belong to the same species. The trifid spicules are distinguished by the relatively short and obtuse head-rays and the regular thickness of the shafts.

In the same deposit there are fragments of relatively large spicules, with robust cylindrical shafts from ·6 to ·9 mm. in thickness, and two short, stout, obtusely-pointed opposite head-rays at the summit. The shafts are all incomplete; the longest fragment measures 3 mm. in length. These abnormal spicules may perhaps pertain to a distinct species from the smaller forms.

These spicules occur in the same beds of decayed chert of Carboniferous age which

* Annals & Mag. Nat. Hist. ser. 4, vol. xx. p. 428, t. 15. f. 31–37.

† Annals & Mag. Nat. Hist. ser. 5, vol. i. p. 140, t. 9. f. 15–19.

have yielded such numerous spicules of Hexactinellid spicules of the genera *Hyalostelia* and *Holasterella*, and they closely resemble these spicules in their condition of preservation. Seen by reflected light they have a dull white aspect; when mounted in Canada balsam and examined by transmitted light, they are nearly entirely opaque. Their surfaces are generally smooth, but in places they are pitted with minute rhombohedral cavities. In comparison with the Hexactinellid forms they are extremely rare.

Distribution. Lower Carboniferous: Law Quarry, Dalry, Ayrshire. From the collection of Mr. James Bennie.

Genus PACHASTRELLA, *O. Schmidt*.

PACHASTRELLA VETUSTA, *Hinde*, n. sp. (Plate XXXVIII. figs. 6, 6*a–f*.)

Detached four-rayed spicules; three of the rays either nearly horizontal or forming the outlines of a three-sided pyramid; the fourth ray is vertical to the other three, and forms the apex of the pyramid; in rare instances the vertical ray is continued below as well as above the pyramidal apex, and the spicule becomes five-rayed. The rays are straight or slightly curved, cylindrical, or very gradually tapering to the extremity, which is usually obtusely rounded, though in one instance the rays terminate in minute digitations. As a rule, the rays in each spicule are unequal in length, the vertical ray being usually the shortest. The spicules vary greatly in size; in a large form the *rays* reach to 2·6 mm. in length by ·47 mm. in thickness, whilst the rays in a small spicule are not more than ·54 mm. in length by ·16 in thickness.

The close resemblance in the general characters of these spicules to those of the Cretaceous species of *Pachastrella*, indicates that this genus dates back to the Carboniferous period*. As a rule, the spicules are larger than in the forms from the Upper Chalk. They occur under the same conditions as the forms described above, and are comparatively rare.

Distribution. Lower Carboniferous: Law Quarry, Dalry, Ayrshire. From the collection of Mr. James Bennie.

* The late Mr. Charles Moore, F.G.S., described and figured under the name of *Grantia antiqua* (Quart. Journ. Geol. Soc. vol. xxiii. 1867, p. 538, pl. xvi. f. 33, 34) some detached triradiate calcareous spicules from the Liassic Conglomerates at Brocastle, South Wales. It is very doubtful if these forms were originally calcareous; they may probably have been siliceous spicules allied to *Pachastrella*, the structure of which has been replaced by calcite.

Order LITHISTIDÆ.

Family *MEGAMORINA*.

Genus DORYDERMA, *Zittel*.

DORYDERMA DALRYENSE, *Hinde*, n. sp. (Plate XXXVIII. figs. 7, 7*a*–*g*.)

Detached spicules, usually more or less curved and irregularly branching; the branches are cylindrical in section, and either obtusely rounded at their terminations or more frequently expanded transversely, and concave so as to be adapted for clasping the surface of adjoining spicules. A fairly large spicule is 1·1 mm. in length and ·18 mm. in thickness. The general resemblance in form and in the termination of the branches of these spicules to those which form the skeleton of the Cretaceous genera *Doryderma*, *Pachypoterion*, and *Heterostinia*, and of the existing genus *Lyidium* is sufficiently close to prove that sponges with this type of spicular structure existed as far back as the Carboniferous epoch.

Mr. Carter* has figured spicules of a similar character, but smaller than those from Dalry, from strata of corresponding age at Ben Bulbul, near Sligo, and has referred them as "in all probability surface-spicules like those of *Corallistes aculeata*." Notwithstanding the difference in size, these Irish forms may probably belong to the same species as those from Dalry.

Distribution. Lower Carboniferous: Law Quarry, Dalry, Ayrshire. From the collection of Mr. James Bennie. Ben Bulbul, near Sligo, Ireland. Presented by Mr. J. Wright of Belfast.

Order HEXACTINELLIDÆ.

Family *EURETIDÆ*.

Genus SPORADOPYLE, *Zittel*.

SPORADOPYLE SANTANDERI, *Hinde*, n. sp. (Plate XXXVIII. figs. 8, 8*a*–*d*.)

The only example of this species is a fragment, 55 mm. in length, of a dichotomously branching sponge. The branches or stems are subcylindrical tubes about 11 mm. in diameter; the walls are from 2·5 to 3 mm. in thickness; the cloaca appears to be cylindrical, and continuous throughout the length of the sponge.

The outer surface exhibits depressed circular or ovate apertures of blind canals about 1 mm. in width, which have a generally vertical arrangement, though not in

* Ann. & Mag. Nat. Hist. ser. 5, vol. vi. (1880) p. 212, t. 14 B. f. 10, 11.

very distinct rows; the interspaces are rounded, and from 1 to 1·8 mm. in width. The canal-apertures are in some cases partially bridged over by extensions of the dermal layer. I have not been able to ascertain the characters of the interior or cloacal surface.

The dermal layer is composed of spicules having a stellate disposition of the rays so as to leave minute circular or irregular interspaces. The interior mesh is regular; the spicules are about ·04 mm. in thickness, and the distance between the nodes is about ·25 mm. The nodes are compact.

The regular mode of growth and the arrangement of the canal-apertures readily distinguish this from the only other branching species of this genus, *S. ramosus*, Quenst. sp.

The unique specimen is partially imbedded in a calcareous matrix; it retains its siliceous structure in beautiful preservation.

Distribution. Neocomian: Santander, Spain.

TABULAR LIST OF SPECIES,

ARRANGED IN ZOOLOGICAL SEQUENCE.

The species marked by an asterisk to the left occur in British strata, whilst the asterisks in the right-hand columns indicate the geological range of each form.

	PALÆOZOIC.					MESOZOIC.							KAINOZOIC.	
								CRETACEOUS.						
	Cambrian.	Ordovian.	Silurian.	Devonian.	Carboniferous.	Triassic.	Jurassic.	Neocomian or Lower Green Sand.	Gault.	Cenomanian or Upper Green Sand and Chloritic Marl.	Grey Chalk, Chalk Marl, and Lower Chalk.	Upper Chalk.	Eocene.	Miocene and Pliocene.
Division I. **SILICEOUS SPONGES.**														
Order MONACTINELLIDÆ, *Zittel.*														
Climacospongia radiata, *Hinde*			*											
Lasiocladia compressa, *Hinde*				*										
*Reniera? Carteri, *Hinde*					*									
*Haplistion fractum, *Hinde*					*									
*Dirrhopalum planum, *Hinde*												*		
*Acanthoraphis intertextus, *Hinde*												*		
*Spongilla Purbeckensis, *Young*							*							
*Cliona cretacea, *Portlock*, sp.												*		*
*Cliona glomerata, *Morris*, sp.												*		
*Cliona? Mantelli, *Wetherell*, sp.												*		
*Cliona, sp.												*	*	*
Order TETRACTINELLIDÆ, *Marshall.*														
*Ophiraphidites anastomans, *Hinde*												*		
*Tethyopsis cretaceus, *Hinde*												*		
*Stelleta inclusa, *Hinde*												*		
*Geodia? clavata, *Hinde*												*		
*Geodia? coronata, *Hinde*												*		
*Geodia? Wrightii, *Hinde*												*		
*Geodia? antiqua, *Hinde*					*									

	Palæozoic.					Mesozoic.							Kainozoic.	
								Cretaceous.						
	Cambrian.	Ordovian.	Silurian.	Devonian.	Carboniferous.	Triassic.	Jurassic.	Neocomian or Lower Green Sand.	Gault.	Cenomanian or Upper Green Sand and Chloritic Marl.	Grey Chalk, Chalk Marl, and Lower Chalk.	Upper Chalk.	Eocene.	Miocene and Pliocene.
*Thenea, sp.												*		
Pachastrella primæva, *Zitt.*												*		
*Pachastrella convoluta, *Hinde*												*		
*Pachastrella plana, *Hinde*												*		
*Pachastrella vetusta, *Hinde*					*									
Order LITHISTIDÆ, *O. Schmidt.*														
Family RHIZOMORINA, *Zittel.*														
Cnemidiastrum stellatum, *Goldf.* sp.							*							
Cnemidiastrum striato-punctatum, *Goldf.* sp.							*							
Cnemidiastrum corallinum, *Quenst.* sp.							*							
Cnemidiastrum Hoheneggeri, *Zitt.*							*							
Cnemidiastrum rimulosum, *Goldf.* sp.							*							
Cnemidiastrum pluristellatum, *Zitt.*							*							
Corallidium diceratinum, *Quenst.* sp.							*							
Hyalotragos patella, *Goldf.* sp.							*							
Hyalotragos radiatum, *Goldf.* sp.							*							
Hyalotragos reticulatum, *Münst.* sp.							*							
Hyalotragos rugosum, *Münst.* sp.							*							
Hyalotragos pezizoides, *Goldf.* sp.							*							
Pyrgochonia acetabulum, *Goldf.* sp.							*							
Leiodorella expansa, *Zitt.*							*							
Platychonia auriformis, *Quenst.* sp.							*							
Platychonia vagans, *Quenst.* sp.							*							
Platychonia, sp.							*							
Bolidium palmatum, *Rœm.* sp.												*		
Chonella tenuis, *Rœm.* sp.												*		
Chonella auriformis, *Rœm.* sp.												*		
*Seliscothon planus, *Phill.* sp.												*		
*Seliscothon explanatus, *Rœm.* sp.												*		
Seliscothon Mantelli, *Goldf.* sp.												*		
Seliscothon testaflorum, *Quenst.* sp.												*		
Seliscothon giganteus, *Rœm.* sp.										*				
Seliscothon, sp.												*		
*Chenendopora fungiformis, *Lamx.*										*		*		
*Chenendopora Michelinii, *Hinde*										*				
Chenendopora pocillum, *Mich.*										*				
Verruculina seriatopora, *Rœm.* sp.												*		
*Verruculina plicata, *Hinde*												*		
*Verruculina astræa, *Hinde*												*		
*Verruculina convoluta, *Quenst.* sp.												*		
*Verruculina pustulosa, *Hinde*												*		
*Verruculina miliaris, *Hinde*												*		
*Verruculina Reussii, *M'Coy*, sp.												*		
Verruculina macrommata, *Rœm.* sp.												*		

	PALÆOZOIC.					MESOZOIC.							KAINOZOIC.	
								Cretaceous.						
	Cambrian.	Ordovian.	Silurian.	Devonian.	Carboniferous.	Triassic.	Jurassic.	Neocomian or Lower Green Sand.	Gault.	Cenomanian or Upper Green Sand and Chloritic Marl.	Grey Chalk, Chalk Marl, and Lower Chalk.	Upper Chalk.	Eocene.	Miocene and Pliocene.
*Verruculina papillata, *Hinde*												*		
Stichophyma turbinata, *Rœm.* sp.												*		
*Stichophyma tumida, *Hinde*												*		
Jereica punctata, *Goldf.* sp.												*		
Jereica polystoma, *Rœm.* sp.												*		
*Jereica clava, *Lee*, sp.												*		
*Jereica cylindrica, *Hinde*										*				
Cœlocorypha, sp.										*				
*Scytalia radiciformis, *Phill.* sp.												*		
*Scytalia fastigiata, *Lee*, sp.												*		
*Scytalia terebrata, *Phill.* sp.												*		
*Stachyspongia spica, *Rœm.* sp.											*	*		
*Pachinion scriptum, *Rœm.* sp.												*		
[Family MEGAMORINA, *Zittel.*														
Placonella perforata, *Hinde*							*							
*Doryderma dichotomum, *Benett*, sp.										*				
*Doryderma ramosum, *Mant.* sp.												*		
*Doryderma Rœmeri, *Hinde*												*		
*Doryderma Benetti, *Hinde*										*				
*Doryderma Dalryense, *Hinde*					*									
*Holodictyon capitatum, *Hinde*										*				
*Pachypoterion robustum, *Hinde*										*				
*Pachypoterion compactum, *Hinde*										*				
*Heterostinia obliqua, *Benett*												*		
*Nematinion calyculum, *Hinde*										*				
Carterella cylindrica, *Zitt.*										*				
Carterella spiculigera, *Rœm.* sp.												*		
*Isoraphinia texta, *Rœm.* sp.												*		
Family ANOMOCLADINA, *Zittel.*														
Cylindrophyma milleporatum, *Goldf.* sp.							*							
Melonella radiata, *Quenst.* sp.							*							
Lecanella pateræformis, *Zitt.*												*		
*Mastosia neocomiensis, *Hinde*								*						
Hindia fibrosa, *Rœm.* sp.			*											
Family TETRACLADINA, *Zittel.*														
Aulocopium cylindraceum, *Rœm.*			*											
*Phymatella intumescens, *Rœm.* sp.												*		
Phymatella heteropora, *Rœm.* sp.												*		
*Phymatella reticulata, *Hinde*												*		
*Phymatella nodosa, *Hinde*										*				
*Phymatella, sp.												*		

	PALÆOZOIC.					MESOZOIC.							KAINOZOIC.	
								CRETACEOUS.						
	Cambrian.	Ordovian.	Silurian.	Devonian.	Carboniferous.	Triassic.	Jurassic.	Neocomian or Lower Green Sand.	Gault.	Cenomanian or Upper Green Sand and Chloritic Marl.	Grey Chalk, Chalk Marl, and Lower Chalk.	Upper Chalk.	Eocene.	Miocene and Pliocene.
Aulaxinia sulcifera, *Rœm.* sp.												*		
*Aulaxinia costata, *Hinde*												*		
Callopegma Schlönbachi, *Zitt.*												*		
*Callopegma obconicum, *Hinde*												*		
*Callopegma ficoideum, *Hinde*												*		
*Trachysycon nodosum, *Hinde*										*				
*Trachysycon sulcatum, *Hinde*												*		
Siphonia piriformis, *Goldf.*										*				
*Siphonia tulipa, *Zitt.*										*				
Siphonia incrassata, *Goldf.*										*				
*Siphonia ficus, *Goldf.*											*			
*Siphonia Königi, *Mant.* sp.												*		
*Siphonia, sp.												*		
*Hallirhoa costata, *Lamx.*										*				
*Hallirhoa costata, var. brevicostata, *Mich.*										*				
Hallirhoa costata, var. Tessonis, *Mich.*										*				
*Hallirhoa costata, var. elevata, *Hinde*										*				
*Hallirhoa agariciformis, *Benett*, sp.										*				
Jerea pyriformis, *Lamx.*										*				
*Jerea Websteri, *Sowerby*, sp.										*				
*Jerea reticulata, *Hinde*									*?	*				
Jerea Quenstedti, *Zitt.*											*			
*Jerea cordiformis, *Hinde*											*			
*Jerea excavata?, *Mich.*												*		
*Nelumbia tuberosa, *Hinde*											*	*		
*Polyjerea arbuscula, *Hinde*										*	*			
*Polyjerea lobata, *Hinde*										*	*			
*Bolospongia globata, *Hinde*												*		
*Bolospongia constricta, *Hinde*												*		
*Thecosiphonia nobilis, *Rœm.* sp.												*		
*Thecosiphonia turbinata, *Hinde*												*		
Calymmatina rimosa, *Zitt.*												*		
*Turonia variabilis, *Mich.*												*		
*Kalpinella pateræformis, *Hinde*										*				
*Kalpinella rugosa, *Hinde*										*				
*Thamnospongia glabra, *Hinde*												*		
*Thamnospongia clavellata, *Benett*, sp.												*		
*Thamnospongia reticulata, *Hinde*											*			
*Pholidocladia dichotomus, *Hinde*												*		
*Pholidocladia ramosus, *Hinde*												*		
Ragadinia rimosa, *Rœm.* sp.												*		
*Ragadinia compressa, *Hinde*												*		
*Ragadinia sulcata, *Hinde*												*		
*Ragadinia clavata, *Hinde*												*		
*Plinthosella squamosa, *Zitt.*												*		
*Plinthosella compacta, *Hinde*												*		
*Plinthosella nodosa, *Hinde*												*		

	PALÆOZOIC.					MESOZOIC.							KAINOZOIC.	
								CRETACEOUS.						
	Cambrian.	Ordovian.	Silurian.	Devonian.	Carboniferous.	Triassic.	Jurassic.	Neocomian or Lower Green Sand.	Gault.	Cenomanian or Upper Green Sand and Chloritic Marl.	Grey Chalk, Chalk Marl, and Lower Chalk.	Upper Chalk.	Eocene.	Miocene and Pliocene.
*Plinthosella convoluta, *Hinde*												*		
*Phymaplectia irregularis, *Hinde*												*		
*Phymaplectia spinosa, *Hinde*												*		
*Phymaplectia cribrata, *Hinde*												*		
*Phymaplectia scitula, *Hinde*												*		
*Rhopalospongia gregaria, *Benett*, sp.										*				
*Rhopalospongia obliqua, *Hinde*										*				
Order HEXACTINELLIDÆ, *O. Schmidt.*														
Suborder DICTYONINA, *Zitt.*														
Family ASTYLOSPONGIDÆ.														
Astylospongia præmorsa, *Goldf.* sp.			*											
Astylospongia stellatim-sulcata, *Rœm.*			*											
Astylospongia inciso-lobata, *Rœm.*			*											
Astylospongia imbricato-articulata, *Rœm.*			*											
Astylospongia Rœmeri, *Hinde*			*											
Palæomanon cratera, *Rœm.*			*											
Family EURETIDÆ, *Zitt.*														
Tremadictyon reticulatum, *Goldf.* sp.							*							
Tremadictyon obliquatum, *Quenst.* sp.							*							
Craticularia clathrata, *Goldf.* sp.							*							
Craticularia parallela, *Goldf.* sp.							*							
Craticularia decorata, *Münst.* sp.							*							
Craticularia paradoxa, *Münst.* sp.							*							
*Craticularia Fittoni, *Mant.* sp.										*	*	*		
*Craticularia subseriata, *Rœm.* sp.												*		
Sphenaulax costata, *Goldf.* sp.							*							
Sporadopyle obliqua, *Goldf.* sp.							*							
Sporadopyle texturata, *Goldf.* sp.							*							
Sporadopyle ramosa, *Quenst.* sp.							*							
Sporadopyle Santanderi, *Hinde*								*						
Sporadopyle, sp.							*							
*Strephinia convoluta, *Hinde*											*			
*Strephinia reteformis, *Hinde*											*			
Verrucocœlia verrucosa, *Goldf.* sp.							*							
Verrucocœlia gregaria, *Quenst.* sp.							*							
*Verrucocœlia tubulata, *T. Smith*, sp.												*		
*Verrucocœlia Vectensis, *Hinde*											*			
*Stauronema Carteri, *Sollas*										*	*			
*Stauronema planum, *Hinde*											*			
Stauronema compactum, *Hinde*										*				
Sestrodictyon convolutum, *Hinde*										*				
Brachiospongia digitata, *D. Owen*, sp.		*												

	PALÆOZOIC.					MESOZOIC.							KAINOZOIC.	
								CRETACEOUS.						
	Cambrian.	Ordovian.	Silurian.	Devonian.	Carboniferous.	Triassic.	Jurassic.	Neocomian or Lower Green Sand.	Gault.	Cenomanian or Upper Green Sand and Chloritic Marl.	Grey Chalk, Chalk Marl, and Lower Chalk.	Upper Chalk.	Eocene.	Miocene and Pliocene.
Family COSCINOPORIDÆ, *Zittel.*														
*Leptophragma Murchisoni, *Goldf.* sp.										*	*	*		
*Leptophragma fragilis, *Rœm.* sp.												*		
*Pleurostoma radiatum, *Rœm.*												*		
Pleurostoma bohemicum, *Zitt.*												*		
*Guettardia stellata, *Mich.*											*	*		
Guettardia radians, *Hinde*										*				
*Coscinopora infundibuliformis, *Goldf.* sp.												*		
*Coscinopora quincuncialis, *T. Smith*, sp.												*		
Family MELLITIONIDÆ, *Zittel.*														
*Aphrocallistes alveolites, *Rœm.* sp.												*		
Family VENTRICULITIDÆ, *Zittel.*														
Pachyteichisma Carteri, *Zitt.*							*							
Pachyteichisma lopas, *Quenst.* sp.							*							
Pachyteichisma, sp.							*							
Trochobolus crassicostus, *Zitt.*							*							
Trochobolus lucernus, *König*							*							
Trochobolus constrictus, *Hinde*							*							
Phlyctænium coniformis, *Quenst.* sp.							*							
*Ventriculites radiatus, *Mant.*												*		
*Ventriculites impressus, *T. Smith*												*		
*Ventriculites convolutus, *Hinde*												*		
Ventriculites poculum, *Zitt.*												*		
*Ventriculites decurrens, *T. Smith*												*		
*Ventriculites mammillaris, *T. Smith*												*		
*Ventriculites infundibuliformis, *S. Woodw.*												*		
*Ventriculites cribrosus, *Phill.* sp.												*		
*Ventriculites angustatus, *Rœm.* sp.												*		
*Ventriculites alcyonoides, *Mant.*												*		
Schizorhabdus libycus, *Zitt.*												*		
*Rhizopoterion cervicorne, *Goldf.* sp.												*		
*Sporadoscinia micrommata, *Rœm.* sp.												*		
Sporadoscinia Decheni, *Goldf.* sp.												*		
*Sporadoscinia capax, *Hinde*											*			
*Sestrocladia furcatus, *Hinde*											*			
*Cœloscyphia sulcata, *Tate*												*		
Polyblastidium luxurians, *Zitt.*												*		
*Polyblastidium racemosum, *T. Smith*, sp.												*		
*Polyblastidium tuberosum, *T. Smith*, sp.												*		
*Cephalites longitudinalis, *T. Smith*												*		
*Cephalites paradoxus, *T. Smith*												*		
*Cephalites Benettiæ, *Mant.*												*		

	PALÆOZOIC.					MESOZOIC.							KAINOZOIC.	
								CRETACEOUS.						
	Cambrian.	Ordovian.	Silurian.	Devonian.	Carboniferous.	Triassic.	Jurassic.	Neocomian or Lower Green Sand.	Gault.	Cenomanian or Upper Green Sand and Chloritic Marl.	Grey Chalk, Chalk Marl, and Lower Chalk.	Upper Chalk.	Eocene.	Miocene and Pliocene.
*Cephalites alternans, *T. Smith*												*		
*Cephalites bullatus, *T. Smith*												*		
*Cephalites catenifer, *T. Smith*												*		
Family STAURODERMIDÆ, *Zittel.*														
Cypellia rugosa, *Goldf.* sp.							*							
Cypellia infundibuliformis, *Goldf.* sp.							*							
Cypellia cæspitosa, *Quenst.* sp.							*							
Cypellia libera, *Quenst.* sp.							*							
Stauroderma Lochense, *Quenst.* sp.							*							
Stauroderma? cylindratum, *Quenst.* sp.							*							
Purisiphonia Clarkei, *Bow.*								*						
Porocypellia pyriformis, *Goldf.* sp.							*							
Casearia articulata, *Goldf.* sp.							*							
Porospongia marginata, *Goldf.* sp.							*							
Porospongia impressa, *Münst.* sp.							*							
*Ophrystoma micrommatum, *Rœm.* sp.											*			
*Ophrystoma ocellatum, *Seeley*, sp.										*				
*Placotrema cretaceum, *Hinde*												*		
*Cincliderma quadratum, *Hinde*												*		
*Eubrochus clausus, *Sollas*										*				
*Protospongia fenestrata, *Salter*	*													
Dictyophyton tuberosum, *Conrad*, sp.				*										
*Dictyophyton Danbyi, *M'Coy*, sp.			*											
*Plectoderma scitulum, *Hinde*			*											
Family MEANDROSPONGIDÆ, *Zittel.*														
*Plocoscyphia fenestrata, *T. Smith*, sp.										*	*			
*Plocoscyphia labrosa, *T. Smith*, sp.										*	*			
*Plocoscyphia pertusa, *Geinitz*								*		*				
*Plocoscyphia reticulata, *Hinde*										*				
*Plocoscyphia subruta, *Quenst.* sp.											*			
*Plocoscyphia convoluta, *T. Smith*, sp.												*		
*Plocoscyphia flexuosa, *Mant.* sp.												*		
*Plocoscyphia labyrinthica, *Mant.* sp.												*		
*Plocoscyphia vagans, *Hinde*												*		
*Plocoscyphia foliacea, *T. Smith*, sp.												*		
*Plocoscyphia elegans, *T. Smith*, sp.												*		
*Tremabolites perforatus, *T. Smith*, sp.												*		
*Etheridgia mirabilis, *Tate*												*		
*Toulminia obliqua, *Hinde*												*		
Toulminia jurassica, *Hinde*							*							
*Camerospongia subrotunda, *Mant.* sp.												*		
*Camerospongia capitata, *T. Smith*, sp.												*		
Camerospongia fungiformis, *Goldf.* sp.												*		

	PALÆOZOIC.					MESOZOIC.							KAINOZOIC.	
								CRETACEOUS.						
	Cambrian.	Ordovician.	Silurian.	Devonian.	Carboniferous.	Triassic.	Jurassic.	Neocomian or Lower Green Sand.	Gault.	Cenomanian or Upper Green Sand and Chloritic Marl.	Grey Chalk, Chalk Marl, and Lower Chalk.	Upper Chalk.	Eocene.	Miocene and Pliocene.
Camerospongia turbinata, *Giebel*, sp.												*		
*Camerospongia campanulata, *T. Smith*, sp.												*		
*Camerospongia aperta, *Hinde*												*		
Cystispongia bursa, *Quenst.* sp.												*		
Family CALLODICTYONIDÆ, *Zittel.*														
*Callodictyon angustatum, *Hinde*												*		
*Porochonia simplex, *T. Smith*, sp.												*		
Becksia Sœkelandi, *Schlüter*												*		
Diplodictyon heteromorphum, *Reuss*, sp.												*		
*Diplodictyon Bayfieldi, *Hinde*												*		
*Sclerokalia Cunningtoni, *Hinde*										*				
Family CŒLOPTYCHIDÆ, *Zittel.*														
*Cœloptychium agaricoides, *Goldf.*												*		
*Cœloptychium deciminum, *Rœm.*												*		
*Cœloptychium furcatum, *Tate*												*		
Cœloptychium Seebachii, *Zitt.*												*		
Cœloptychium sulciferum, *Rœm.*												*		
Cœloptychium lobatum, *Goldf.*												*		
Suborder LYSSAKINA, *Zittel.*														
Family MONAKIDÆ, *Marshall.*														
Astræospongia meniscus, *Rœm.*			*											
Astræospongia patina, *Rœm.*			*											
*Stauractinella cretacea, *Hinde*												*		
Family POLLAKIDÆ, *Marshall.*														
*Hyalostelia Smithii, *Young and Young*, sp.					*									
*Hyalostelia parallela, *M'Coy*, sp.		*			*									
*Hyalostelia fasciculus, *M'Coy*, sp.		*												
*Hyalostelia fusiformis, *Hinde*												*		
*Holasterella conferta, *Carter*					*									
*Holasterella Youngi, *Hinde*					*									
*Holasterella Wrightii, *Carter*					*									
*Holasterella Benniei, *Hinde*					*									
INCERTÆ SEDIS.														
*Amphispongia oblonga, *Salt*			*											
Mortiera vertebralis, *De Koninck*					*									

	Palæozoic.					Mesozoic.							Kainozoic.	
								Cretaceous.						
	Cambrian.	Ordovian.	Silurian.	Devonian.	Carboniferous.	Triassic.	Jurassic.	Neocomian or Lower Green Sand.	Gault.	Cenomanian or Upper Green Sand and Chloritic Marl.	Grey Chalk, Chalk Marl, and Lower Chalk.	Upper Chalk.	Eocene.	Miocene and Pliocene.
Division II. **CALCAREOUS SPONGES.**														
Order CALCISPONGIÆ, *Blainville.*														
Family PHARETRONES, *Zittel.*														
Eudea Manon, *Münst.* sp.						*								
Eudea polymorpha, *Klipst.* sp.						*								
Eudea clavata, *Lamx.*							*							
Eudea perforata, *Quenst.* sp.							*							
Eudea globata, *Quenst.* sp.							*							
Eudea pisa, *Quenst.* sp.							*							
Eudea hirsuta, *Quenst.* sp.							*							
Colospongia dubia, *Münst.* sp.						*								
Enoplocœlia armata, *Klipst.* sp.						*								
Celyphia submarginata, *Münst.* sp.						*								
Himatella milleporata, *Münst.* sp.						*								
Peronella subcæspitosa, *Münst.* sp.						*								
*Peronella cymosa, *Lamx.* sp.							*							
*Peronella pistilliformis, *Lamx.* sp.							*							
Peronella clavarioides, *Lamx.* sp.							*							
*Peronella mamillifera, *Lamx.* sp.							*							
*Peronella tenuis, *Hinde*							*							
Peronella inflata, *Hinde*							*							
*Peronella cylindrica, *Goldf.* sp.							*							
Peronella radiciformis, *Quenst.* sp.							*							
Peronella Michelini, *Etallon*, sp.							*							
Peronella nodulosa, *Quenst.* sp.							*							
Peronella clavata, *Rœm.* sp.								*						
Peronella truncata, *From.* sp.								*						
*Peronella ramosa, *Rœm.* sp.								*						
*Peronella Gillieroni, *Loriol*, sp.								*						
*Peronella prolifera, *Hinde*								*						
Peronella flabellata, *D'Orbigny*, sp.								*						
*Peronella furcata, *Goldf.* sp.										*				
Peronella ramosissima, *Dun.*										*				
Peronella ocellata, *Hinde*												*		
*Tremacystia D'Orbignyi, *Hinde*										*				
*Tremacystia siphonioides, *Mich.* sp.										*				
Tremacystia cribrosa, *Goldf.* sp.										*				
*Tremacystia anastomans, *Mant.* sp.								*						
*Tremacystia irregularis, *Hinde*								*						
*Tremacystia clavata, *Keeping*, sp.								*						
*Elasmocœlia crassa, *From.* sp.								*						
*Elasmocœlia Farringdonensis, *Mant.* sp.								*						
*Elasmocœlia Mantelli, *Hinde*								*						

	PALÆOZOIC.					MESOZOIC.							KAINOZOIC.	
								CRETACEOUS.						
	Cambrian.	Ordovian.	Silurian.	Devonian.	Carboniferous.	Triassic.	Jurassic.	Neocomian or Lower Green Sand.	Gault.	Cenomanian or Upper Green Sand and Chloritic Marl.	Grey Chalk, Chalk Marl, and Lower Chalk.	Upper Chalk.	Eocene.	Miocene and Pliocene.
Conocœlia crassa, *From.* sp.								*						
Conocœlia centrolævis, *Rœm.* sp.								*						
*Eusiphonella Bronnii, *Münst.* sp.							*							
Eusiphonella intermedia, *Münst.* sp.							*							
Eusiphonella perplexa, *Quenst.* sp.							*							
Corynella gracilis, *Münst.* sp.						*								
Corynella pyriformis, *Klipst.* sp.						*								
Corynella rosa, *Laube*, sp.						*								
Corynella astroites, *Münst.* sp.						*								
Corynella capitata, *Münst.* sp.						*								
Corynella lycoperdioides, *Lam.* sp.							*							
Corynella costata, *Stahl*, sp.							*							
Corynella Quenstedti, *Zitt.*							*							
Corynella aspera, *From.* sp.							*							
Corynella madreporata, *Quenst.* sp.							*							
*Corynella foraminosa, *Goldf.* sp.								*		*				
Corynella tetragona, *Goldf.* sp.										*				
*Corynella rugosa, *Hinde*										*				
*Corynella socialis, *Hinde*										*				
Corynella multidigitata, *Mich.*										*				
Myrmecium hieroglypha, *Klipst.* sp.						*								
Myrmecium hemisphericum, *Goldf.* sp.							*							
Myrmecium indutum, *Quenst.* sp.							*							
*Lymnorea mamillosa, *Lamx.*							*							
*Inobolia inclusa, *Hinde*							*							
Stellispongia rotularis, *Münst.* sp.						*								
Stellispongia variabilis, *Münst.* sp.						*								
Stellispongia hybrida, *Münst.* sp.						*								
*Stellispongia stellata, *Lamx.* sp.							*							
*Stellispongia corallina, *From.* sp.							*							
Stellispongia glomerata, *Quenst.* sp.							*							
*Stellispongia semicincta, *Quenst.* sp.							*							
Sestrostomella cribrata, *Quenst.* sp.							*							
Sestrostomella rugosa, *Hinde*										*				
Sestrostomella clavata, *Hinde*										*				
Trachysinia aspera, *Hinde*							*							
Trachysinia solitaria, *Hinde*							*							
Trachysinia minor, *Hinde*							*							
Blastinia costata, *Goldf.* sp.							*							
Blastinia alata, *Quenst.* sp.							*							
*Synopella pulvinaria, *Goldf.* sp								*						
Synopella sphærica, *Mich.* sp.										*				
Synopella Goldfussi, *Hinde*												*		
Oculospongia binoculata, *Quenst.* sp.							*							
*Oculospongia dilatata, *Rœm.* sp.								*						
Oculospongia tubulifera, *Goldf.* sp.												*		
Crispispongia pezizoides, *Zitt.*							*							

	PALÆOZOIC.					MESOZOIC.							KAINOZOIC.	
								CRETACEOUS.						
	Cambrian.	Ordovian.	Silurian.	Devonian.	Carboniferous.	Triassic.	Jurassic.	Neocomian or Lower Green Sand.	Gault.	Cenomanian or Upper Green Sand and Chloritic Marl.	Grey Chalk, Chalk Marl, and Lower Chalk.	Upper Chalk.	Eocene.	Miocene and Pliocene.
Crispispongia expansa, *Quenst.*							*							
*Diaplectia auricula, *Hinde*							*							
*Diaplectia helvelloides, *Lam.* sp.							*							
Elasmostoma acutimargo, *Rœm.* sp.								*						
*Elasmostoma Normanianum, *D'Orb.* sp.										*				
*Elasmostoma consobrinum, *D'Orb.* sp.										*				
*Elasmostoma scitulum, *Hinde*												*		
*Elasmostoma crassum, *Hinde*												*		
Elasmostoma plicatum, *Hinde*										*				
Elasmostoma subpeziza, *D'Orb.* sp.												*		
*Raphidonema contortum, *Hinde*								*						
*Raphidonema porcatum, *Sharpe*, sp.								*						
*Raphidonema pustulatum, *Hinde*								*						
*Raphidonema macropora, *Sharpe*, sp.								*						
Raphidonema stellatum, *Goldf.* sp										*				
*Raphidonema Farringdonense, *Sharpe*, sp.								*						
*Pharetrospongia Strahani, *Sollas*										*		*		
*Pachytilodia infundibuliformis, *Goldf.* sp.										*				
Family SYCONES, *Haeckel.*														
Protosycon punctatum, *Goldf.* sp.							*							
INCERTÆ SEDIS.														
Bactronella pusillum, *Hinde*							*							

TABULAR LIST OF SPECIES,

ARRANGED IN STRATIGRAPHICAL SEQUENCE.

The asterisk indicates that the forms thus marked occur in British strata.

PALÆOZOIC.

CAMBRIAN SYSTEM.

Order Hexactinellidæ.

*Protospongia fenestrata, *Salter*.

ORDOVIAN SYSTEM.

Order Hexactinellidæ.

Brachiospongia digitata, *D. Owen*.
*Hyalostelia parallela, *M'Coy*. sp.
*Hyalostelia fasciculus, *M'Coy*, sp.

SILURIAN SYSTEM.

Order Monactinellidæ.

Climacospongia radiata, *Hinde*.

Order Lithistidæ.

Hindia fibrosa, *Rœm*. sp.
Aulocopium cylindraceum, *Rœm*.

Incertæ sedis.

*Amphispongia oblonga, *Salt*.

Order Hexactinellidæ.

Astylospongia præmorsa, *Goldf*. sp.
Astylospongia stellatim-sulcata, *Rœm*.
Astylospongia inciso-lobata, *Rœm*.
Astylospongia imbricato-articulata, *Rœm*.
Astylospongia Rœmeri, *Hinde*.
Palæomanon cratera, *Rœm*.
*Dictyophyton Danbyi, *M'Coy*, sp.
*Plectoderma scitulum, *Hinde*.
Astræospongia meniscus, *Rœm*.
Astræospongia patina, *Rœm*.

DEVONIAN SYSTEM.

Order Monactinellidæ.

Lasiocladia compressa, *Hinde*.

Order Hexactinellidæ.

Dictyophyton tuberosum, *Conrad*, sp.

CARBONIFEROUS SYSTEM.

Order Monactinellidæ.

*Reniera ? Carteri, *Hinde*.
*Haplistion fractum, *Hinde*.

Order Tetractinellidæ.

*Geodia ? antiqua, *Hinde*.
*Pachastrella vetusta, *Hinde*.

Order Lithistidæ.

*Doryderma Dalryense, *Hinde*.

Order Hexactinellidæ.

*Hyalostelia Smithii, *Young & Young*, sp.
*Hyalostelia parallela, *M'Coy*, sp.
*Holasterella conferta, *Carter*.
*Holasterella Youngi, *Hinde*.
*Holasterella Wrightii, *Carter*.
*Holasterella Benniei, *Hinde*.

Incertæ sedis.

Mortiera vertebralis, *de Koninck*.

MESOZOIC.

TRIASSIC SYSTEM.

Order Calcispongiæ.

Eudea Manon, *Münst.* sp.
Eudea polymorpha, *Klipst.* sp.
Colospongia dubia, *Münst.* sp.
Enoplocœlia armata, *Klipst.* sp.
Celyphia submarginata, *Münst.* sp.
Himatella milleporata, *Münst.* sp.
Peronella subcæspitosa, *Münst.* sp.
Corynella gracilis, *Münst.* sp.
Corynella pyriformis, *Klipst.* sp.
Corynella rosa, *Laube*, sp.
Corynella astroites, *Münst.* sp.
Corynella capitata, *Münst.* sp.
Myrmecium hieroglypha, *Klipst.* sp.
Stellispongia rotularis, *Münst.* sp.
Stellispongia variabilis, *Münst.* sp.
Stellispongia hybrida, *Münst.* sp.

JURASSIC SYSTEM.

Order Monactinellidæ.

*Spongilla Purbeckensis, *Young*.

Order Lithistidæ.

Cnemidiastrum stellatum, *Goldf.* sp.
Cnemidiastrum striato-punctatum, *Goldf.* sp.
Cnemidiastrum corallinum, *Quenst.* sp.
Cnemidiastrum Hoheneggeri, *Zitt.*
Cnemidiastrum rimulosum, *Goldf.* sp.
Cnemidiastrum pluristellatum, *Zitt.*
Corallidium diceratinum, *Quenst.* sp.
Hyalotragos patella, *Goldf.* sp.
Hyalotragos radiatum, *Goldf.* sp.
Hyalotragos reticulatum, *Münst.* sp.
Hyalotragos rugosum, *Münst.* sp.
Hyalotragos pezizoides, *Goldf.* sp.
Pyrgochonia acetabulum, *Goldf.* sp.
Leiodorella expansa, *Zitt.*

Platychonia auriformis, *Quenst.* sp.
Platychonia vagans, *Quenst.* sp.
Platychonia, sp.
Placonella perforata, *Hinde.*
Cylindrophyma milleporatum, *Goldf.* sp.
Melonella radiata, *Quenst.* sp.

Order Hexactinellidæ.

Tremadictyon reticulatum, *Goldf.* sp.
Tremadictyon obliquatum, *Quenst.* sp.
Craticularia clathrata, *Goldf.* sp.
Craticularia parallela, *Goldf.* sp.
Craticularia decorata, *Münst.* sp.
Craticularia paradoxa, *Münst.* sp.
Sphenaulax costata, *Goldf.* sp.
Sporadopyle obliqua, *Goldf.* sp.
Sporadopyle texturata, *Goldf.* sp.
Sporadopyle ramosa, *Quenst.* sp.
Sporadopyle, sp.
Verrucocœlia verrucosa, *Goldf.* sp.
Verrucocœlia gregaria, *Quenst.* sp.
Pachyteichisma Carteri, *Zitt.*
Pachyteichisma lopas, *Quenst.* sp.
Pachyteichisma, sp.
Trochobolus crassicostus, *Zitt.*
Trochobolus lucernus, *König.*
Trochobolus constrictus, *Hinde.*
Phlyctænium coniformis, *Quenst.* sp.
Cypellia rugosa, *Goldf.* sp.
Cypellia infundibuliformis, *Goldf.* sp.
Cypellia cæspitosa, *Quenst.* sp.
Cypellia libera, *Quenst.* sp.
Stauroderma Lochense, *Quenst.* sp.
Stauroderma ? cylindratum, *Quenst.* sp.
Porocypellia pyriformis, *Goldf.* sp.
Casearia articulata, *Goldf.* sp.
Porospongia marginata, *Goldf.* sp.
Porospongia impressa, *Münst.* sp.
Toulminia jurassica, *Hinde.*

Order Calcispongiæ.

Eudea clavata, *Lamx.*
Eudea perforata, *Quenst.* sp.
Eudea globata, *Quenst.* sp.
Eudea pisa, *Quenst.* sp.
Eudea hirsuta, *Quenst.* sp.
*Peronella cymosa, *Lamx.* sp.
*Peronella pistilliformis, *Lamx.* sp.
Peronella clavarioides, *Lamx.* sp.
*Peronella mamillifera, *Lamx.* sp.
*Peronella tenuis, *Hinde.*
Peronella inflata, *Hinde.*
*Peronella cylindrica, *Goldf.* sp.
Peronella radiciformis, *Quenst.* sp.
Peronella Michelini, *Etallon,* sp.
Peronella nodulosa, *Quenst.* sp.
*Eusiphonella Bronnii, *Münst.* sp.
Eusiphonella intermedia, *Münst.* sp.
Eusiphonella perplexa, *Quenst.* sp.
Corynella lycoperdioides, *Lamx.* sp.
Corynella costata, *Stahl,* sp.
Corynella Quenstedti, *Zitt.*
Corynella aspera, *From.* sp.
Corynella madreporata, *Quenst.* sp.
Myrmecium hemisphericum, *Goldf.* sp.
Myrmecium indutum, *Quenst.* sp.
*Lymnorea mamillosa, *Lamx.*
*Inobolia inclusa, *Hinde.*
*Stellispongia stellata, *Lamx.* sp.
*Stellispongia corallina, *From.* sp.
Stellispongia glomerata, *Quenst.* sp.
*Stellispongia semicincta, *Quenst.* sp.
Sestrostomella cribrata, *Quenst.* sp.
Trachysinia aspera, *Hinde.*
Trachysinia solitaria, *Hinde.*
Trachysinia minor, *Hinde.*
Blastinia costata, *Goldf.* sp.
Blastinia alata, *Quenst.* sp.
Oculospongia binoculata, *Quenst.* sp.
Crispispongia pezizoides, *Zitt.*
Crispispongia expansa, *Quenst.*
*Diaplectia auricula, *Hinde.*
*Diaplectia helvelloides, *Lamx.* sp.
Protosycon punctatum, *Goldf.* sp.
Bactronella pusillum, *Hinde.*

CRETACEOUS SYSTEM.

Neocomian or Lower Green Sand.

Order Lithistidæ.

*Mastosia neocomiensis, *Hinde*.

Order Hexactinellidæ.

Sporadopyle Santanderi, *Hinde*.
Purisiphonia Clarkei, *Bow*.
*Plocoscyphia pertusa, *Gein*.

Order Calcispongiæ.

Peronella clavata, *Rœm*. sp.
Peronella truncata, *From*. sp.
*Peronella ramosa, *Rœm*. sp.
*Peronella Gillieroni, *Loriol*, sp.
*Peronella prolifera, *Hinde*.
Peronella flabellata, *D'Orbig*. sp.
*Tremacystia anastomans, *Mant*. sp.
*Tremacystia irregularis, *Hinde*.
*Tremacystia clavata, *Keeping*, sp.
*Elasmocœlia crassa, *From*. sp.
*Elasmocœlia Farringdonensis, *Mant*. sp.
*Elasmocœlia Mantelli, *Hinde*.
Conocœlia crassa, *From*. sp.
Conocœlia centrolævis, *Rœm*. sp.
*Corynella foraminosa, *Goldf*. sp.
*Synopella pulvinaria, *Goldf*. sp.
*Oculospongia dilatata, *Rœm*. sp.
Elasmostoma acutimargo, *Rœm*. sp.
*Raphidonema contortum, *Hinde*.
*Raphidonema porcatum, *Sharpe*, sp.
*Raphidonema pustulatum, *Hinde*.
*Raphidonema macropora, *Sharpe*, sp.
*Raphidonema Farringdonense, *Sharpe*, sp.

Gault.

Order Lithistidæ.

*Jerea reticulata, *Hinde*.

Cenomanian or Upper Green Sand and Chloritic Marl.

Order Lithistidæ.

Seliscothon giganteus, *Rœm*. sp.
*Chenendopora fungiformis, *Lamx*.
*Chenendopora Michelinii, *Hinde*.
Chenendopora pocillum, *Mich*.
*Jerea cylindrica, *Hinde*.
Cœlocorypha, sp.
*Doryderma dichotomum, *Benett*, sp.
*Doryderma Benetti, *Hinde*.
*Holodictyon capitatum, *Hinde*.
*Pachypoterion robustum, *Hinde*.
*Pachypoterion compactum, *Hinde*.
*Nematinion calyculum, *Hinde*.
Carterella cylindrica, *Zitt*.
*Phymatella nodosa, *Hinde*.
*Trachysycon nodosum, *Hinde*.
Siphonia piriformis, *Goldf*.
*Siphonia tulipa, *Zitt*.
Siphonia incrassata, *Goldf*.
*Hallirhoa costata, *Lamx*.
*Hallirhoa costata, var. brevicostata, *Mich*.
Hallirhoa costata, var. Tessonis, *Mich*.
*Hallirhoa costata, var. elevata, *Hinde*.
*Hallirhoa agariciformis, *Benett*, sp.
Jerea pyriformis, *Lamx*.
*Jerea Websteri, *Sowerby*, sp.
*Jerea reticulata, *Hinde*.
*Polyjerea arbuscula, *Hinde*.
*Polyjerea lobata, *Hinde*.
*Kalpinella pateræformis, *Hinde*.
*Kalpinella rugosa, *Hinde*.
*Rhopalospongia gregaria, *Benett*, sp.
*Rhopalospongia obliqua, *Hinde*.

Order HEXACTINELLIDÆ.

*Craticularia Fittoni, *Mant.* sp.
*Stauronema Carteri, *Sollas.*
Stauronema compactum, *Hinde.*
Sestrodictyon convolutum, *Hinde.*
*Leptophragma Murchisoni, *Goldf.* sp.
Guettardia radians, *Hinde.*
*Ophrystoma ocellatum, *Seeley,* sp.
*Eubrochus clausus, *Sollas.*
*Plocoscyphia fenestrata, *T. Smith,* sp.
*Plocoscyphia labrosa, *T. Smith,* sp.
Plocoscyphia pertusa, *Gein.*
*Plocoscyphia reticulata, *Hinde.*
Sclerokalia Cunningtoni, *Hinde.*

Order CALCISPONGIÆ.

*Peronella furcata, *Goldf.* sp.
Peronella ramosissima, *Dun.*
*Tremacystia D'Orbignyi, *Hinde.*
*Tremacystia siphonioides, *Mich.* sp.
Tremacystia cribrosa, *Goldf.* sp.
Corynella foraminosa, *Goldf.* sp.
Corynella tetragona, *Goldf.* sp.
*Corynella rugosa, *Hinde.*
*Corynella socialis, *Hinde.*
Corynella multidigitata, *Mich.* sp.
Sestrostomella rugosa, *Hinde.*
Sestrostomella clavata, *Hinde.*
Synopella sphærica, *Mich.* sp.
*Elasmostoma Normanianum, *D'Orb.* sp.
*Elasmostoma consobrinum, *D'Orb.* sp.
Elasmostoma plicatum, *Hinde.*
Raphidonema stellatum, *Goldf.* sp.
*Pharetrospongia Strahani, *Sollas.*
*Pachytilodia infundibuliformis, *Goldf.* sp.

GREY CHALK, CHALK MARL, AND LOWER CHALK.

Order LITHISTIDÆ.

*Stachyspongia spica, *Rœm.* sp.
*Siphonia ficus, *Goldf.*
Jerea Quenstedti, *Zitt.*
*Jerea cordiformis, *Hinde.*
*Nelumbia tuberosa, *Hinde.*
*Polyjerea arbuscula, *Hinde.*
*Polyjerea lobata, *Hinde.*
*Thamnospongia? reticulata, *Hinde.*

Order HEXACTINELLIDÆ.

*Craticularia Fittoni, *Mant.* sp.
*Strephinia convoluta, *Hinde.*
*Strephinia reteformis, *Hinde.*
*Verrucocœlia Vectensis, *Hinde.*
*Stauronema Carteri, *Sollas.*
*Stauronema planum, *Hinde.*
*Leptophragma Murchisoni, *Goldf.* sp.
*Guettardia stellata, *Mich.*
*Sporadoscinia capax, *Hinde.*
*Sestrocladia furcatus, *Hinde.*
*Ophrystoma micrommatum, *Rœm.* sp.
*Plocoscyphia fenestrata, *T. Smith,* sp.
*Plocoscyphia labrosa, *T. Smith,* sp.
*Plocoscyphia subruta, *Quenst.* sp.

UPPER CHALK AND MAESTRICHT CHALK.

Order MONACTINELLIDÆ.

*Dirrhopalum planum, *Hinde.*
*Acanthoraphis intertextus, *Hinde.*
*Cliona cretacea, *Portlock,* sp.
*Cliona glomerata, *Morris,* sp.
*Cliona? Mantelli, *Wetherell,* sp.
*Cliona, sp.

Order TETRACTINELLIDÆ.

*Ophiraphidites anastomans, *Hinde.*
*Tethyopsis cretaceus, *Hinde.*
*Stelletta inclusa, *Hinde.*
*Geodia? clavata, *Hinde.*
*Geodia? coronata, *Hinde.*
*Geodia? Wrightii, *Hinde.*

*Thenea, sp.
Pachastrella primæva, *Zitt.*
*Pachastrella convoluta, *Hinde.*
*Pachastrella plana, *Hinde.*

Order Lithistidæ.

Bolidium palmatum, *Rœm.* sp.
Chonella tenuis, *Rœm.* sp.
Chonella auriformis, *Rœm.* sp.
*Seliscothon planus, *Phill.* sp.
*Seliscothon explanatus, *Rœm.* sp.
Seliscothon Mantelli, *Goldf.* sp.
Seliscothon testa-florum, *Quenst.* sp.
Seliscothon, sp.
Chenendopora fungiformis, *Lamx.*
Verruculina seriatopora, *Rœm.* sp.
*Verruculina plicata, *Hinde.*
*Verruculina astræa, *Hinde.*
*Verruculina convoluta, *Quenst.* sp.
*Verruculina pustulosa, *Hinde.*
*Verruculina miliaris, *Hinde.*
*Verruculina Reussii, *M'Coy*, sp.
Verruculina macrommata, *Rœm.* sp.
*Verruculina papillata, *Hinde.*
Stichophyma turbinata, *Rœm.* sp.
*Stichophyma tumida, *Hinde.*
Jereica punctata, *Goldf.* sp.
Jereica polystoma, *Rœm.* sp.
*Jereica clava, *Lee*, sp.
*Scytalia radiciformis, *Phill.* sp.
*Scytalia fastigiata, *Lee*, sp.
*Scytalia terebrata, *Phill.* sp.
*Stachyspongia spica, *Rœm.* sp.
*Pachinion scriptum, *Rœm.* sp.
*Doryderma ramosum, *Mant.* sp.
*Doryderma Rœmeri, *Hinde.*
*Heterostinia obliqua, *Benett*, sp.
Carterella spiculigera, *Rœm.* sp.
*Isoraphinia texta, *Rœm.* sp.
Lecanella pateræformis, *Zitt.*
*Phymatella intumescens, *Rœm.* sp.
Phymatella heteropora, *Rœm.* sp.
*Phymatella reticulata, *Hinde.*
*Phymatella, sp.
Aulaxinia sulcifera, *Rœm.* sp.
*Aulaxinia costata, *Hinde.*
Callopegma Schlönbachi, *Zitt.*
*Callopegma obconicum, *Hinde.*
*Callopegma ficoideum, *Hinde.*
*Trachysycon sulcatum, *Hinde.*
*Siphonia Königi, *Mant.* sp.
*Siphonia, sp.
*Jerea excavata? *Mich.*
*Nelumbia tuberosa, *Hinde.*
*Bolospongia globata, *Hinde.*
*Bolospongia constricta, *Hinde.*
*Thecosiphonia nobilis, *Rœm.* sp.
*Thecosiphonia turbinata, *Hinde.*
Calymmatina rimosa, *Zitt.*
*Turonia variabilis, *Mich.*
*Thamnospongia glabra, *Hinde.*
*Thamnospongia clavellata, *Benett*, sp.
*Pholidocladia dichotomus, *Hinde.*
*Pholidocladia ramosus, *Hinde.*
Ragadinia rimosa, *Rœm.* sp.
*Ragadinia compressa, *Hinde.*
*Ragadinia sulcata, *Hinde.*
*Ragadinia clavata, *Hinde.*
*Plinthosella squamosa, *Zitt.*
*Plinthosella compacta, *Hinde.*
*Plinthosella nodosa, *Hinde.*
*Plinthosella convoluta, *Hinde.*
*Phymaplectia irregularis, *Hinde.*
*Phymaplectia spinosa, *Hinde.*
*Phymaplectia cribrata, *Hinde.*
*Phymaplectia scitula, *Hinde.*

Order Hexactinellidæ.

*Craticularia Fittoni, *Mant.* sp.
*Craticularia subseriata, *Rœm.* sp.
*Verrucocœlia tubulata, *T. Smith*, sp.
*Leptophragma Murchisoni, *Goldf.* sp.
*Leptophragma gracilis, *Rœm.* sp.
*Pleurostoma radiatum, *Rœm.*
Pleurostoma bohemicum, *Zitt.*
*Guettardia stellata, *Mich.*
*Coscinopora infundibuliformis, *Goldf.*
*Coscinopora quincuncialis, *T. Smith*, sp.
*Aphrocallistes alveolites, *Rœm.* sp.
*Ventriculites radiatus, *Mant.*

*Ventriculites impressus, *T. Smith.*
*Ventriculites convolutus, *Hinde.*
Ventriculites poculum, *Zitt.*
*Ventriculites decurrens, *T. Smith.*
*Ventriculites mammillaris, *T. Smith.*
*Ventriculites infundibuliformis, *S. Woodw.*
*Ventriculites cribrosus, *Phill.* sp.
*Ventriculites angustatus, *Rœm.* sp.
*Ventriculites alcyonoides, *Mant.*
Schizorhabdus libycus, *Zitt.*
*Rhizopoterion cervicorne, *Goldf.* sp.
*Sporadoscinia micrommata, *Rœm.* sp.
Sporadoscinia Decheni, *Goldf.* sp.
*Cœloscyphia sulcata, *Tate.*
Polyblastidium luxurians, *Zitt.*
*Polyblastidium racemosum, *T. Smith,* sp.
*Polyblastidium tuberosum, *T. Smith,* sp.
*Cephalites longitudinalis, *T. Smith.*
*Cephalites paradoxus, *T. Smith.*
*Cephalites Benettiæ, *Mant.* sp.
*Cephalites alternans, *T. Smith.*
*Cephalites bullatus, *T. Smith.*
*Cephalites catenifer, *T. Smith.*
*Placotrema cretaceum, *Hinde.*
*Cincliderma quadratum, *Hinde.*
*Plocoscyphia convoluta, *T. Smith,* sp.
*Plocoscyphia flexuosa, *Mant.* sp.
*Plocoscyphia labyrinthica, *Mant.* sp.
*Plocoscyphia vagans, *Hinde.*
*Plocoscyphia foliacea, *T. Smith,* sp.
*Plocoscyphia elegans, *T. Smith,* sp.
*Tremabolites perforatus, *T. Smith,* sp.
*Etheridgia mirabilis, *Tate.*
*Toulminia obliqua, *Hinde.*
*Camerospongia subrotunda, *Mant.* sp.
*Camerospongia capitata, *T. Smith,* sp.
Camerospongia fungiformis, *Goldf.* sp.
Camerospongia turbinata, *Giebel,* sp.
*Camerospongia campanulata, *T. Smith,* sp.
*Camerospongia aperta, *Hinde.*
Cystispongia bursa, *Quenst.* sp.
*Callodictyon angustatum, *Hinde.*
*Porochonia simplex, *T. Smith,* sp.
Becksia Sœkelandi, *Schlüter.*
Diplodictyon heteromorphum, *Rœm.* sp.
*Diplodictyon Bayfieldi, *Hinde.*
*Cœloptychium agaricoides, *Goldf.*
*Cœloptychium deciminum, *Rœm.*
*Cœloptychium furcatum, *Tate.*
Cœloptychium Seebachi, *Zitt.*
Cœloptychium sulciferum, *Rœm.*
Cœloptychium lobatum, *Goldf.*
*Stauractinella cretacea, *Hinde.*
*Hyalostelia fusiformis, *Hinde.*

Order Calcispongiæ.

Peronella ocellata, *Hinde.*
Synopella Goldfussi, *Hinde.*
Oculospongia tubulifera, *Goldf.* sp.
*Elasmostoma scitulum, *Hinde.*
*Elasmostoma crassum, *Hinde.*
Elasmostoma subpeziza, *D'Orbigny,* sp.
*Pharetrospongia Strahani, *Sollas.*

KAINOZOIC SYSTEM.

Eocene.

Order Monactinellidæ.

Cliona, sp.

Miocene and Pliocene.

Cliona cretacea, *Portlock,* sp.
Cliona, sp.

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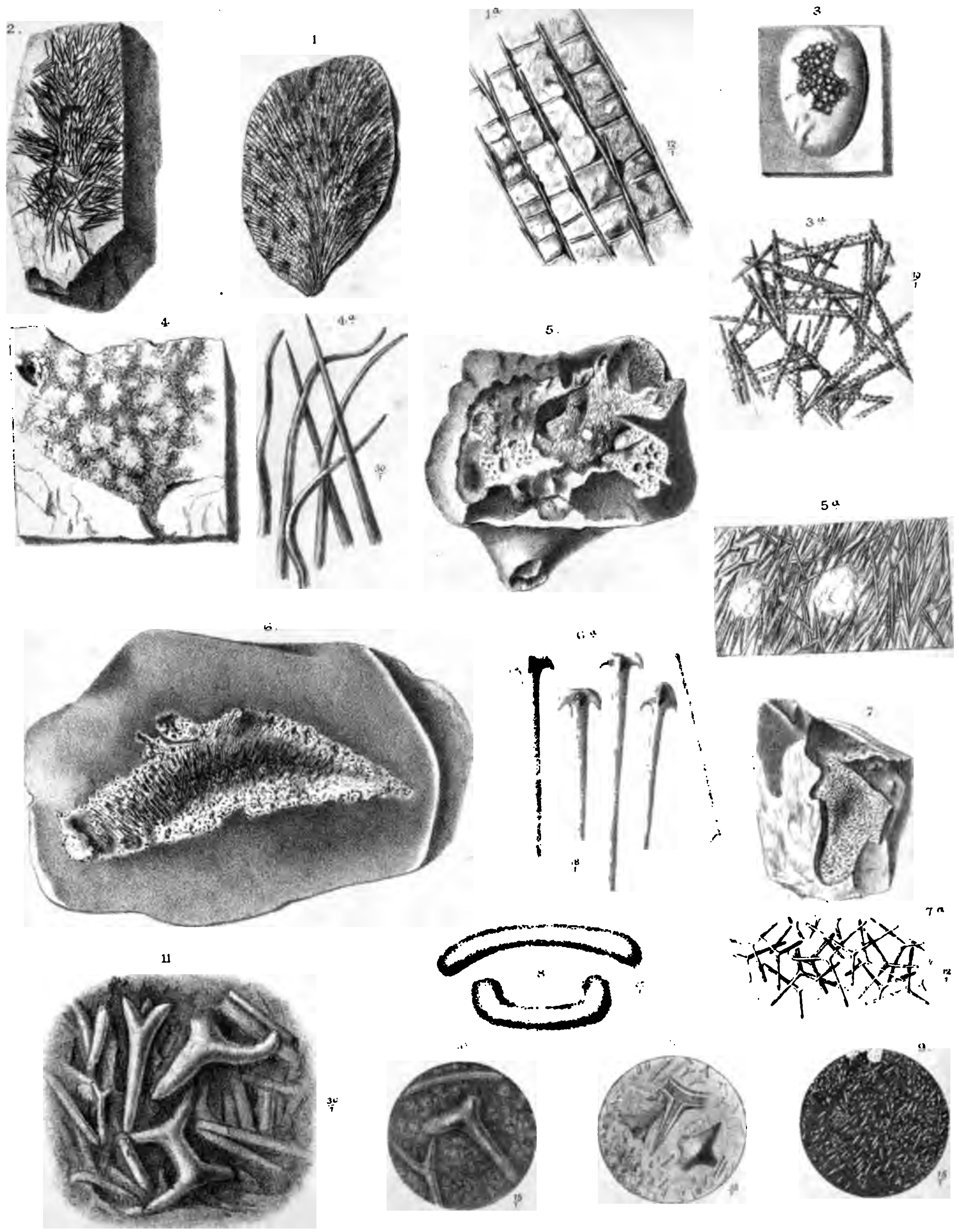

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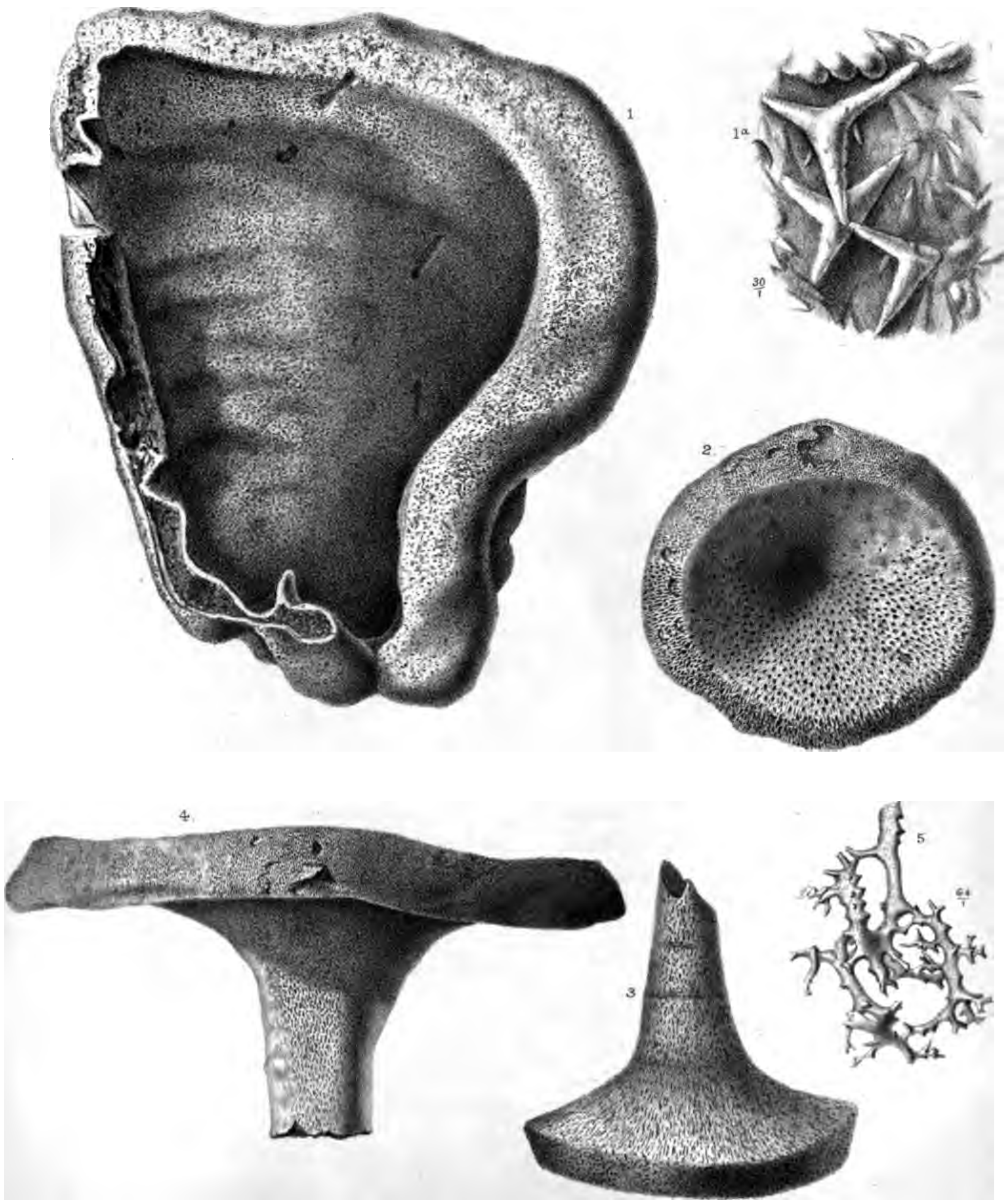

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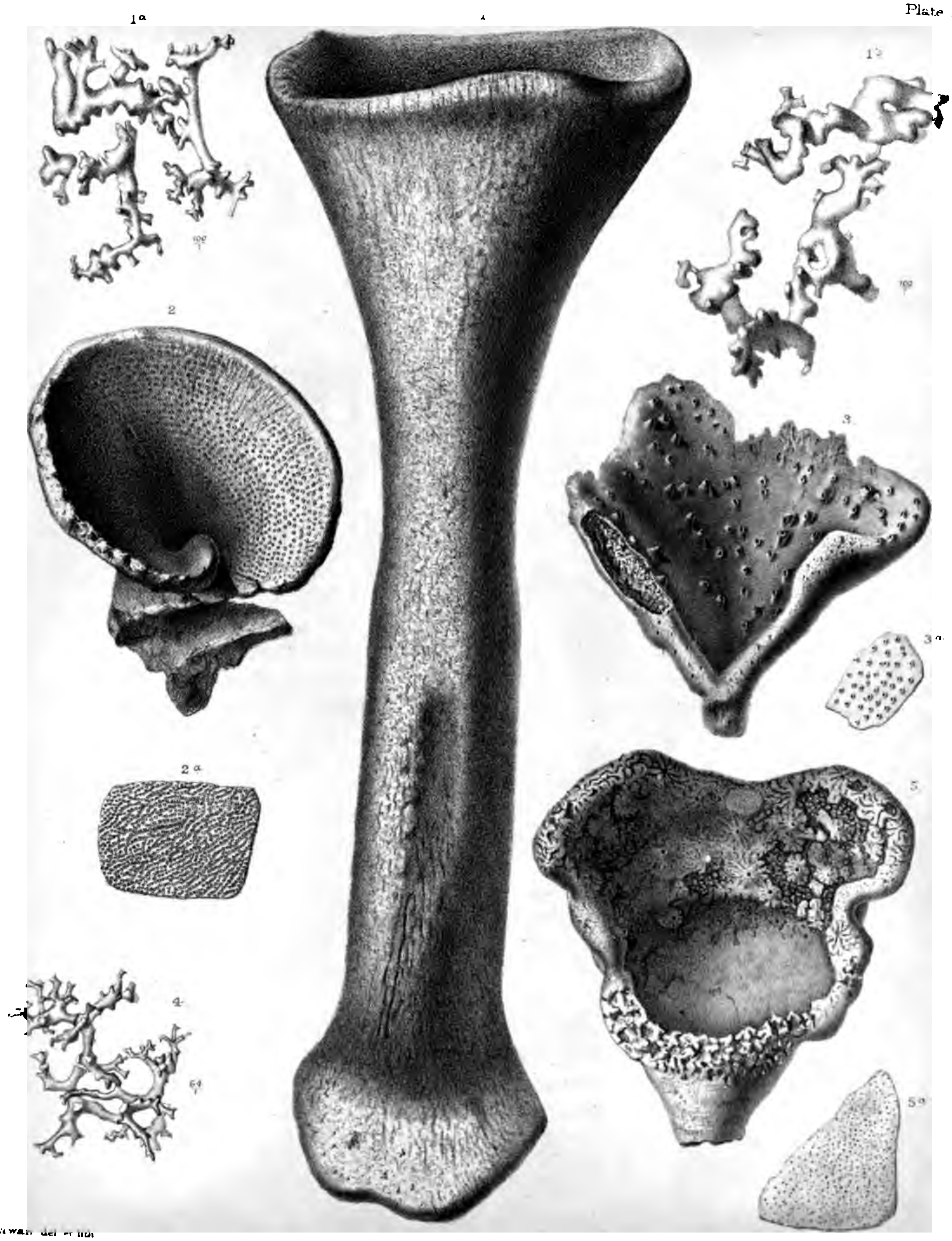

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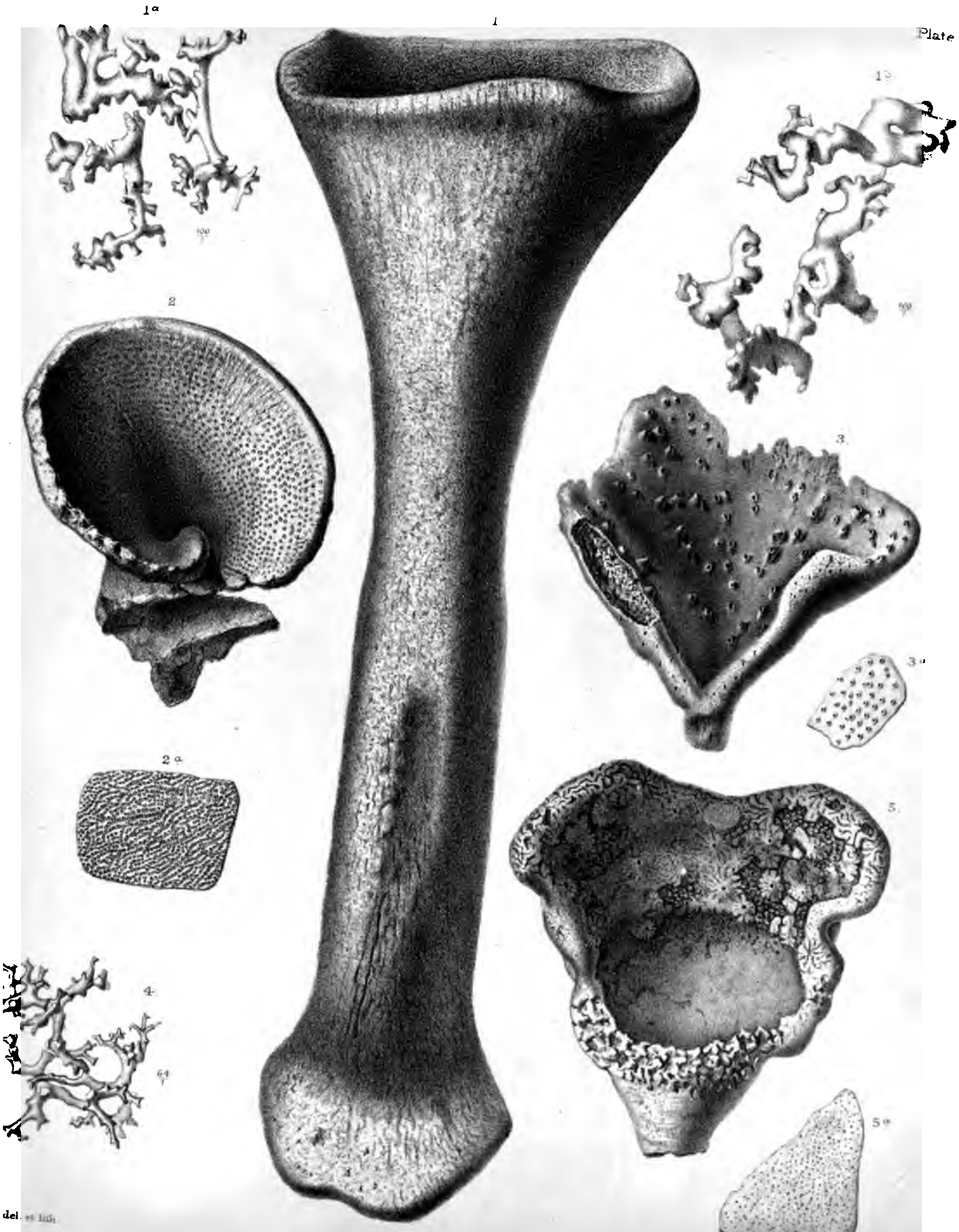

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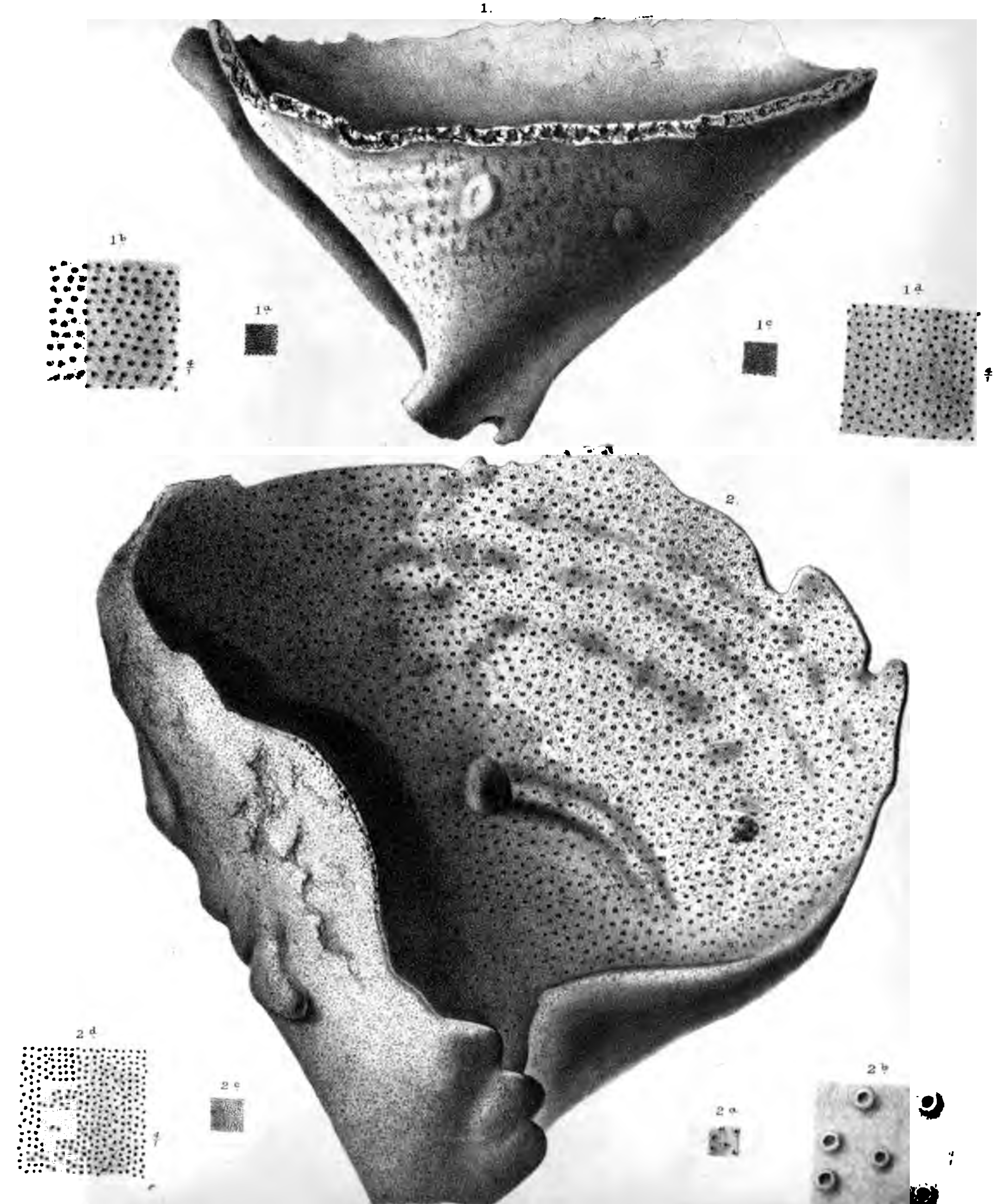

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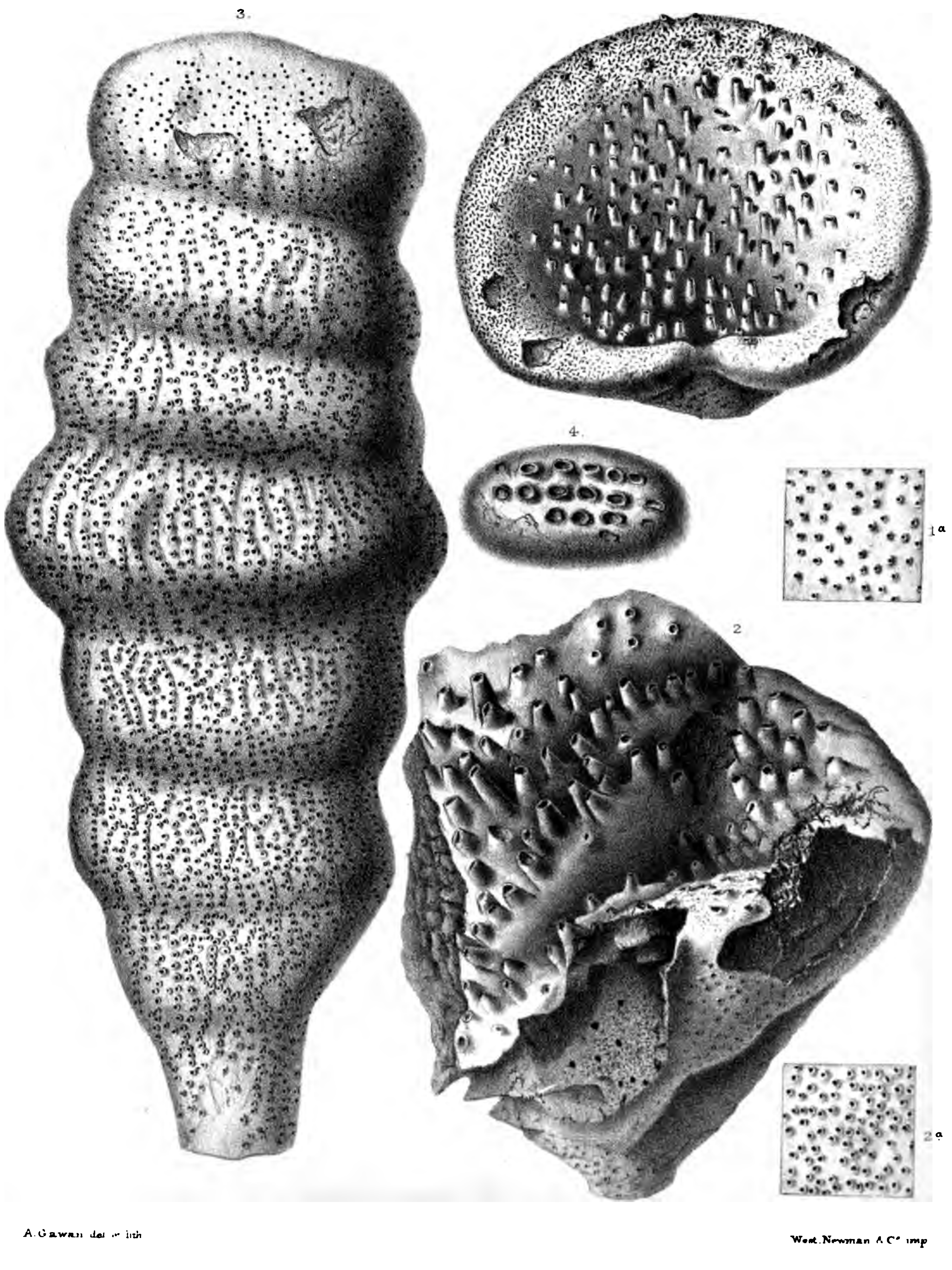

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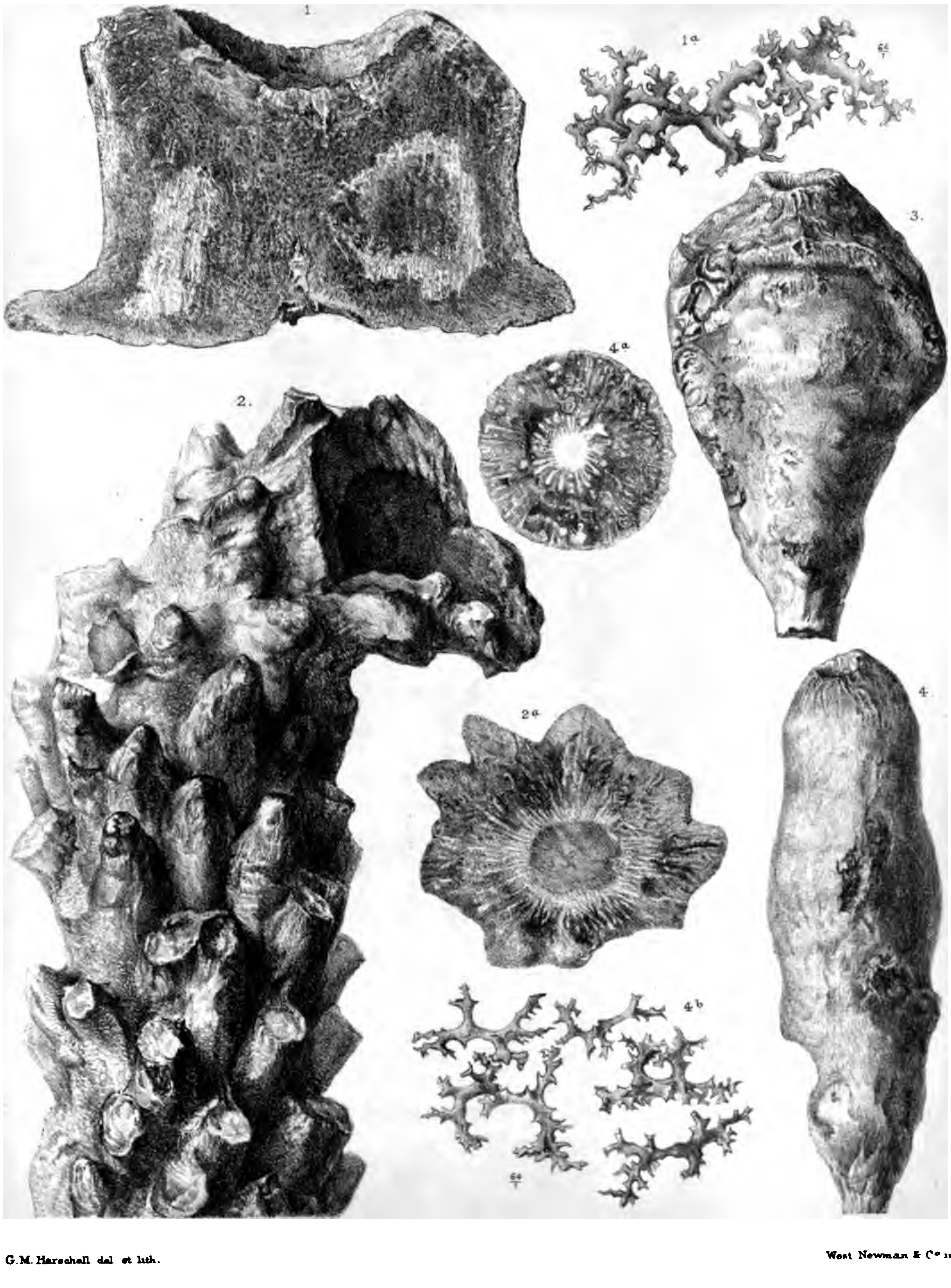

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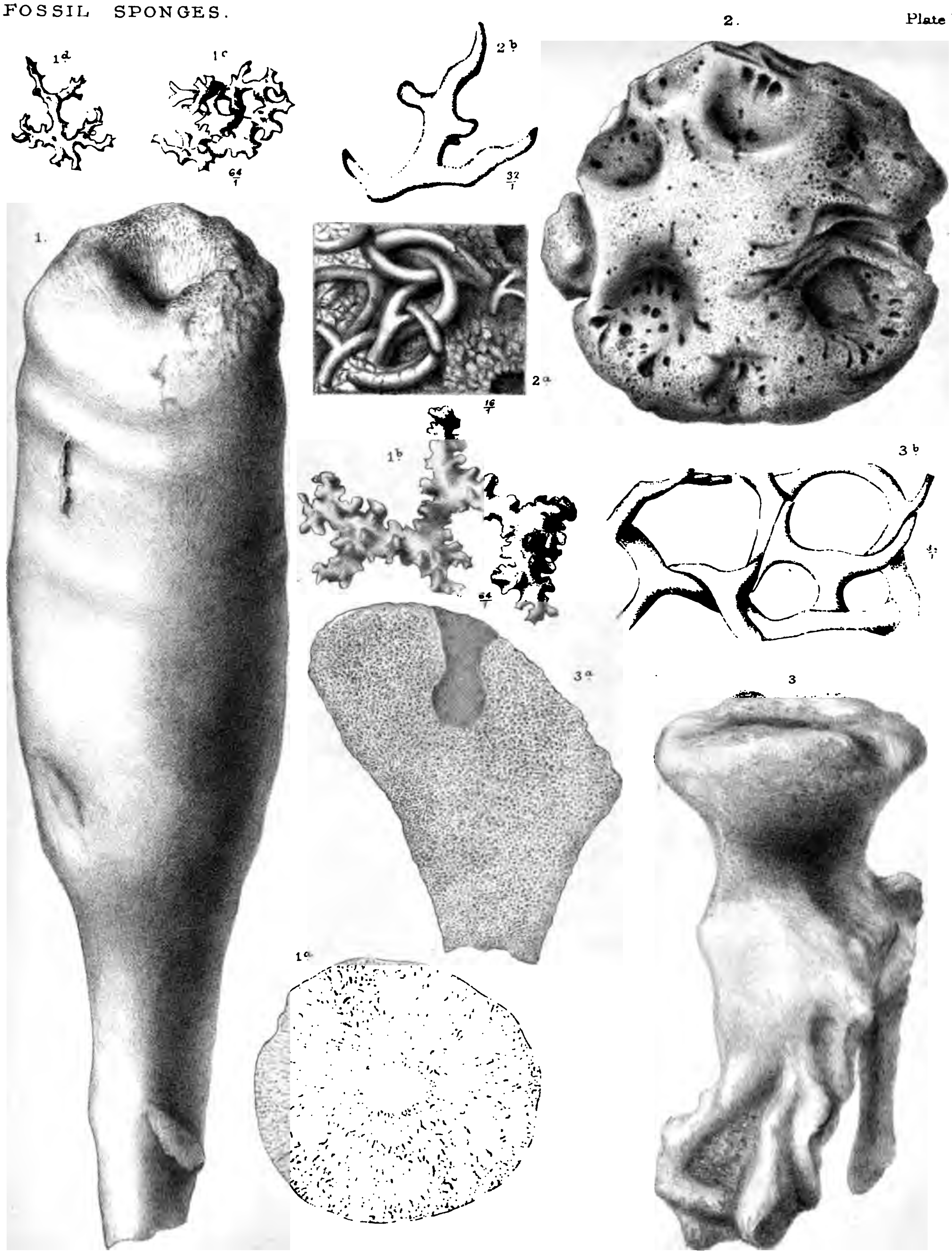

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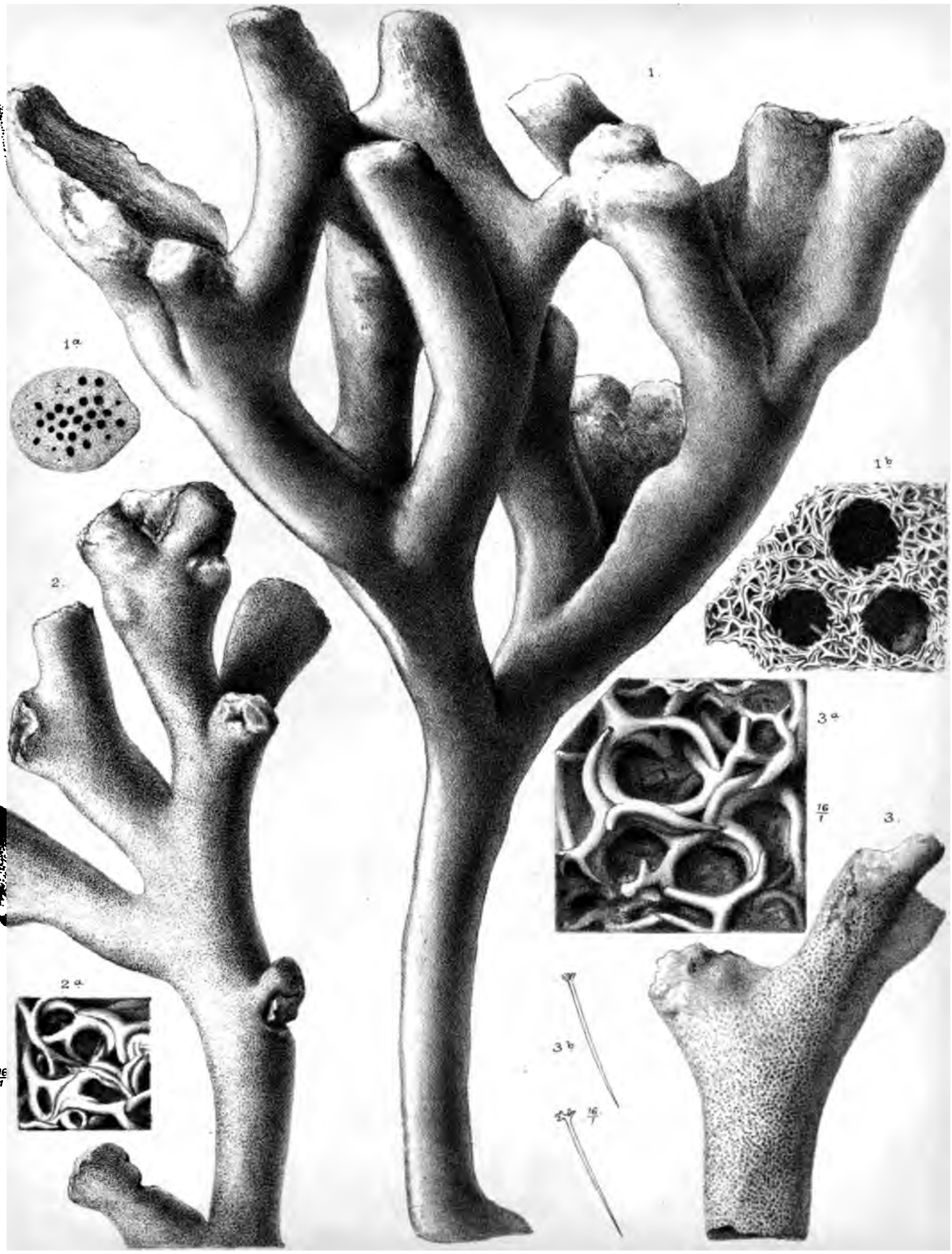

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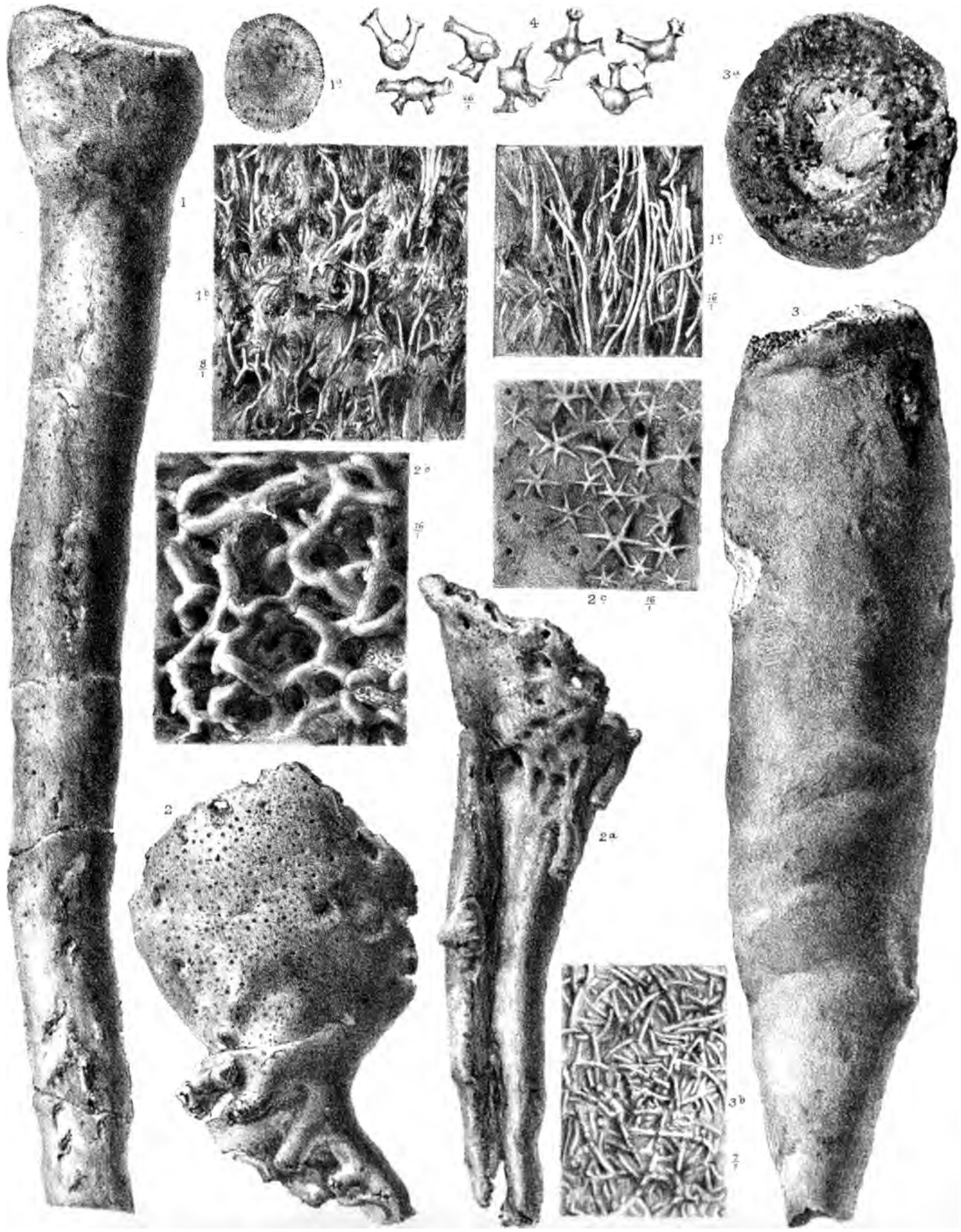

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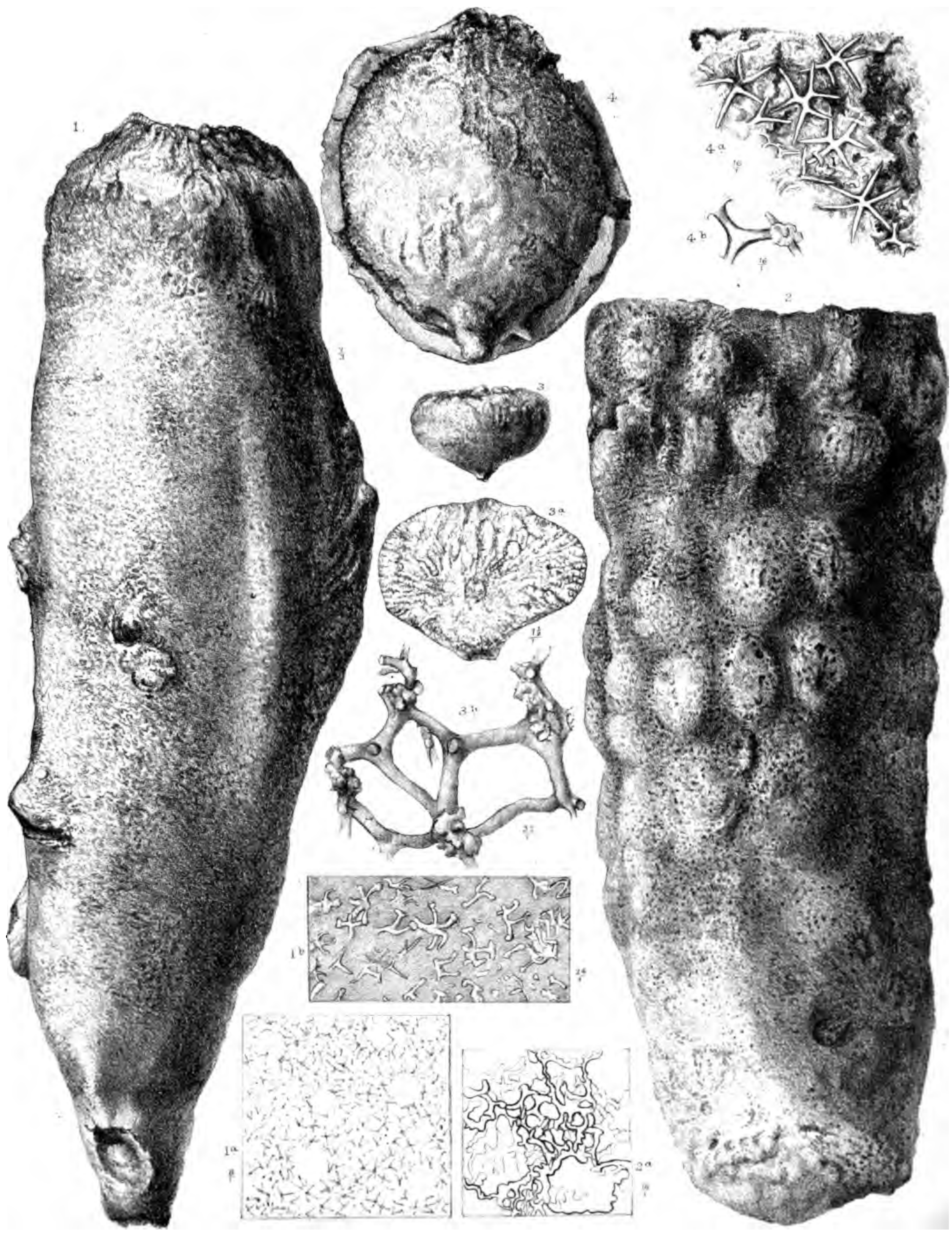

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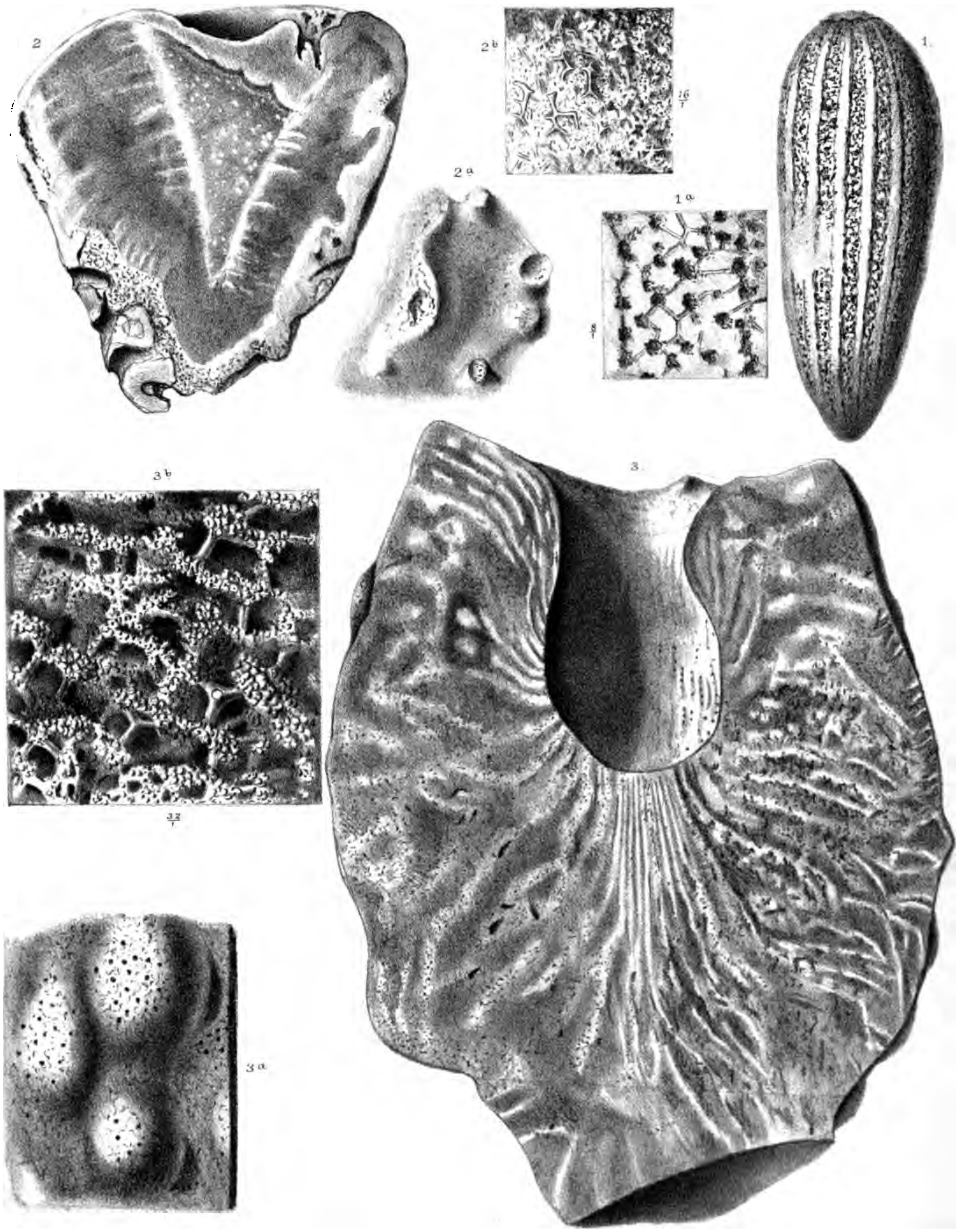

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Fig. 1. ***Hallirhoa costata***, Lamx. A small three-lobed specimen from the Upper Green Sand at Warminster, Wiltshire. Natural size 67

Fig. 1 *a*. ***The same***. A conical, partially five-lobed, example from the same locality, showing the stem and the root-like extensions at its termination. Natural size.

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Fig. 1 *d*. ***The same***. A transverse section of a five-lobed example, taken below the level of the cloaca, showing in section the larger vertical canals. Drawn from a polished specimen presented to the Museum by Robert Etheridge, sen., Esq., F.R.S.

Fig. 1 *e*. ***The same***. Portion of the interior spicular mesh, enlarged sixty-four times. Drawn from a transparent microscopic section by means of the camera lucida. The small square to the left indicates the natural size.

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Fig. 3. ***Hallirhoa costata***, var. ***elevata***, Hinde. Two-thirds the natural size. From Warminster 68

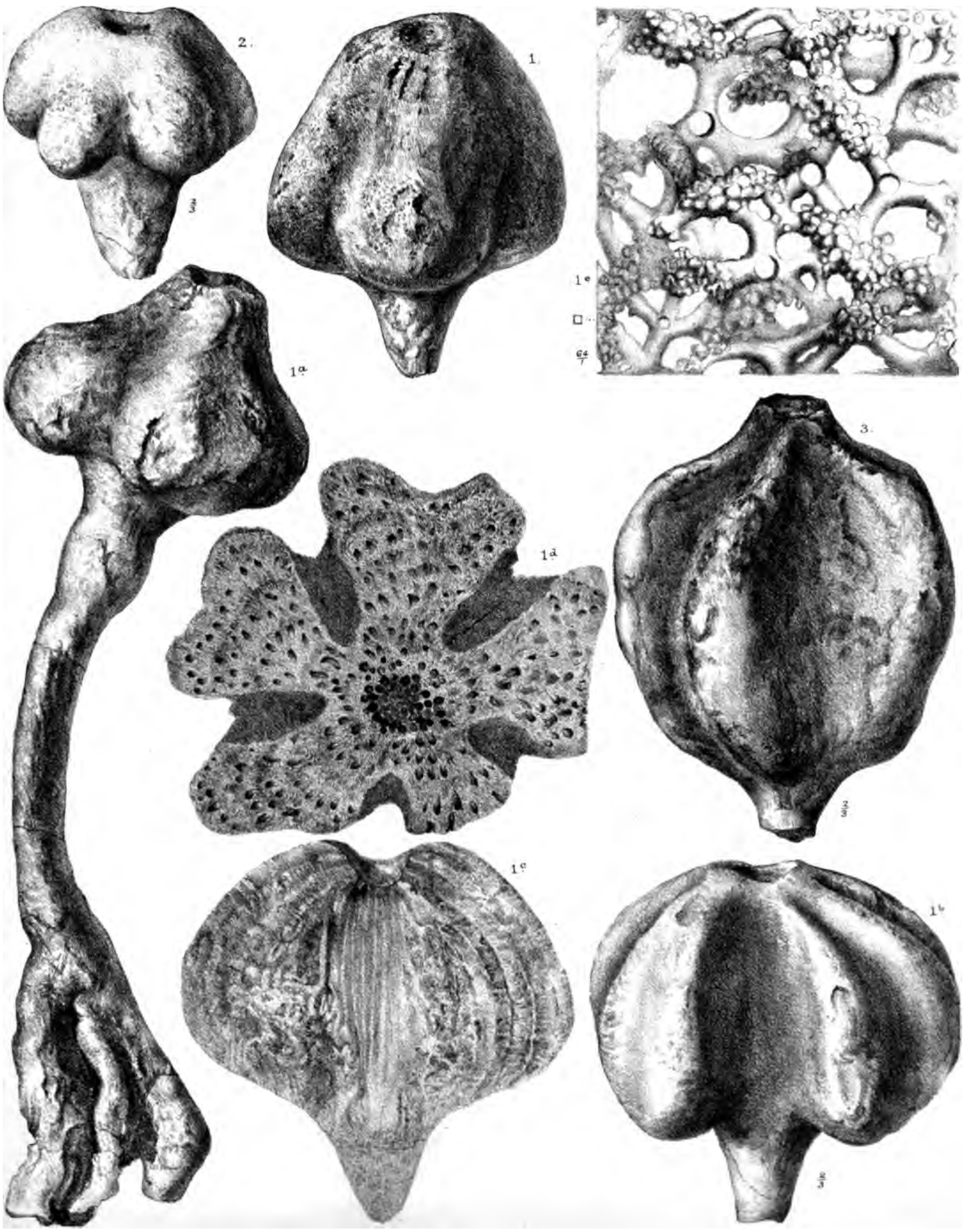

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Fig. 1 *a*. *The same*. Two spicules from the interior mesh of another Warminster specimen. Enlarged seventy-two times. Drawn from a transparent section by means of the camera lucida.

Fig. 1 *b*. *The same*. Portion of the outer surface of a specimen in which the dermal layer has been preserved, showing the laciniated disciform heads of its component spicules. Enlarged thirty-two times. The specimen is from Warminster, and belongs to the Jermyn-Street Museum.

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Fig. 2 *b*. *The same*. A vertical median section of a specimen from the Upper Green Sand at Warminster, showing the disposition of the radial canals. Natural size.

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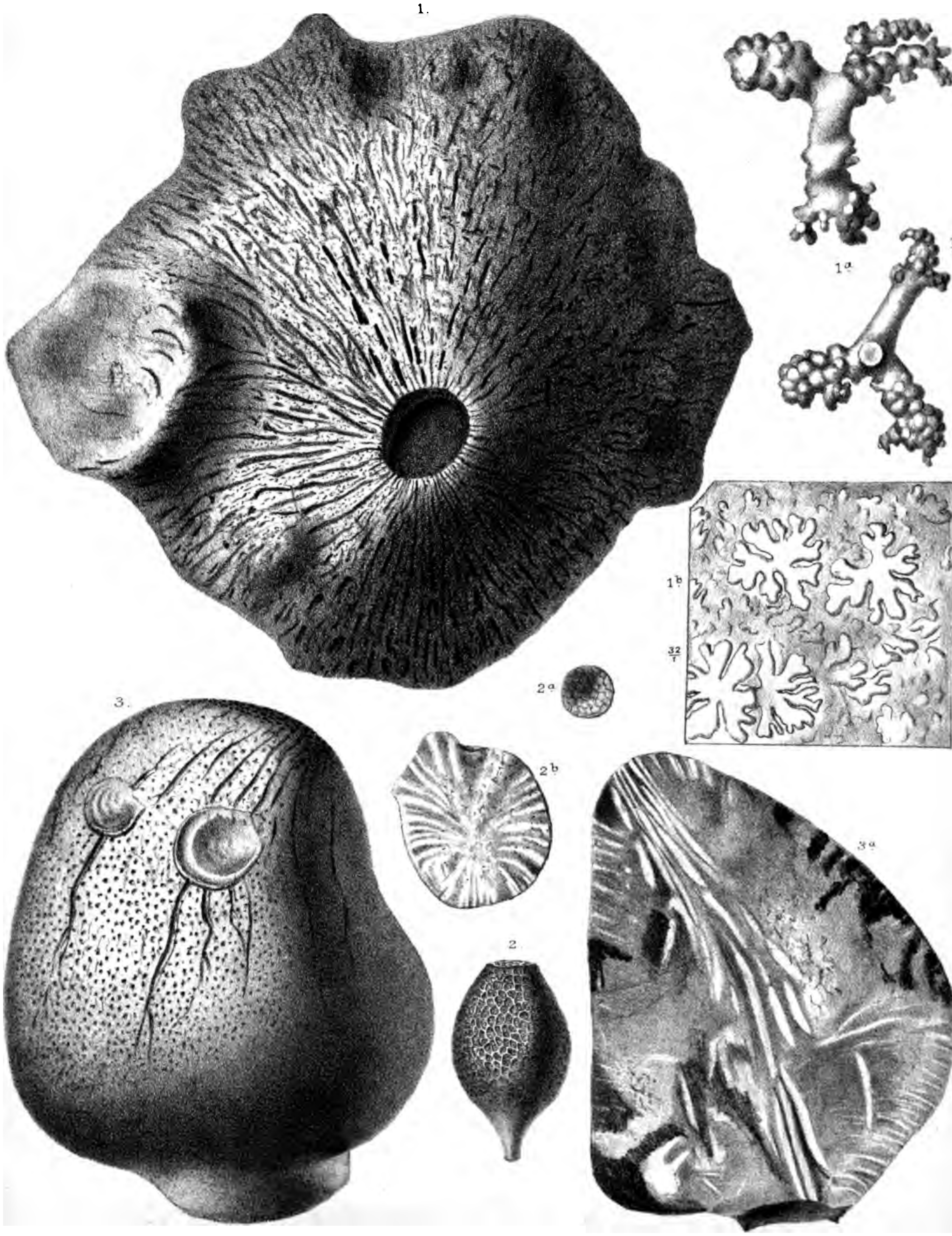

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Fig. 1. *Nelumbia tuberosa,* Hinde. From the Grey Chalk near Dover. Natural size . . **72**

Fig. 1 *a*. *The same*. A transverse section from the central portion of fig. 1, showing the disposition of the vertical canals and faint traces of the radial canals. Natural size.

Fig. 1 *b*. *The same*. A portion of 1 *a*, enlarged thirty-two times, showing traces of the spicular skeleton. The original siliceous skeleton has been replaced by calcite, and where the spicules are in contact their forms have been indistinguishably merged together; occasionally, however, the separate rays can be recognized. A section of a Foraminifer is also shown in the matrix of grey chalk.

Fig. 1 *c*. *The same*. Portion of the dermal layer of a specimen from the Upper Chalk, enlarged thirty-two times, showing the heads of large compound trifid spicules and traces of numerous smaller ones, and also of the mesh-spicules beneath.

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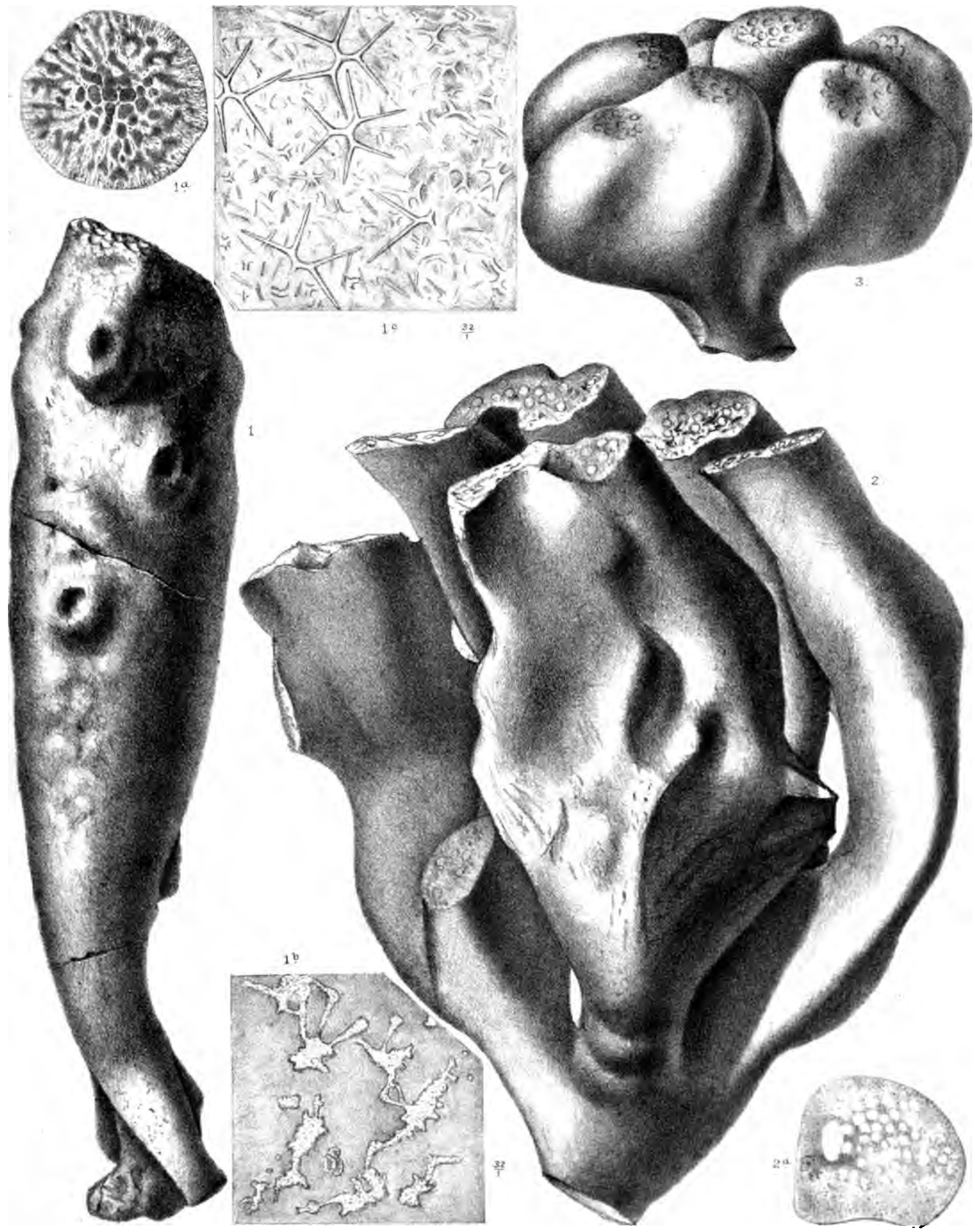
Fig. 2 *a*. *The same*. Transverse section of one of the branches of the same specimen, showing the distribution of the longitudinal canals and faint traces of the spicular skeleton, which is now calcareous. The sponge is preserved in a matrix of Grey Chalk.

Fig. 3. *Polyjerea lobata,* Hinde. Natural size. From the Grey Chalk near Dover . . . **73**


1a
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2
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2a

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Fig. 1. ***Bolospongia globata,*** Hinde. Natural size. From the Upper Chalk at Flamborough, Yorkshire 74

Fig. 1 *a*. ***The same***. Vertical section of another specimen from the same locality. The dotted portions indicate the spicular structure, and the interspaces represent the wide channels and loculi of the interior of the sponge. Natural size.

Fig. 1 *b*. ***The same***. Portion of 1 *a*, enlarged thirty-two times, showing in the lighter portions traces of the spicular structure. The spicules have been replaced by crystalline calcite and silica, and are only recognizable where they were not in close contact with each other originally. The square below the figure indicates its natural size. Drawn from a transparent section by means of the camera lucida.

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Fig. 5 *a*. ***The same***. Portion of the interior spicular structure immediately beneath the dermal layer, showing the tuberculated spicules. Enlarged sixty-four times.

Fig. 5 *b*. ***The same***. Portion of the dermal layer of fig. 5, enlarged thirty-two times. The dark figures represent the hollow moulds of the larger spicules of the dermal layer. The two lighter figures below represent the spicules themselves. The entire dermal layer is formed of similar spicules; but, as a rule, only the larger forms can be distinguished.

Fig. 5 *c*. ***The same***. Portion of the dermal layer of a specimen, enlarged thirty-two times, showing slightly elevated spaces with groups of circular pores. From Upper-Chalk detritus at Budleigh Salterton, Devonshire. Presented to the Museum by Mr. H. J. Carter, F.R.S.

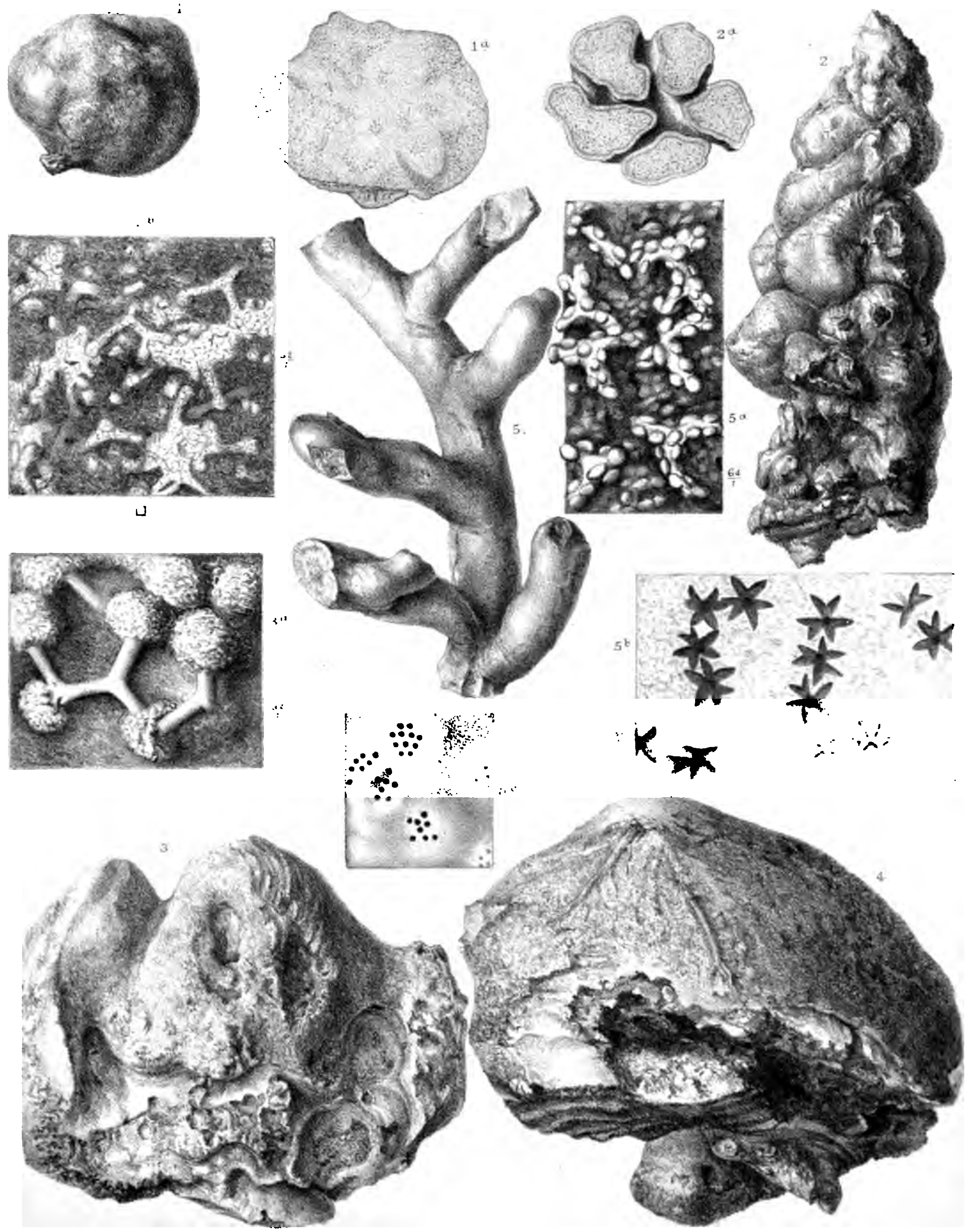

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Fig. 1. ***Turonia variabilis,*** Mich. sp. Natural size. Showing the furrowed upper surface and the smooth dermal layer of the base. Probably from the Senonian of France 76

Fig. 2. ***Thamnospongia clavellata,*** Benett, sp. A specimen inclosed in flint. From the Upper Chalk at Chicklade, Wiltshire. Natural size 79

Fig. 2 *a*. ***The same.*** Another flint-inclosed specimen, showing traces of longitudinal canals on the fractured end of one of the branches. Natural size. From the Upper Chalk at Stockton, Wiltshire.

Fig. 2 *b*. ***The same.*** Portion of the outer surface of a specimen from Stockton, showing some of the larger heads of the compound trifid spicules of the dermal layer. Enlarged thirty-two times.

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Fig. 3 *a*. ***The same.*** Transverse section of one of the stems, showing the central canal and traces of the sinuous canals which open into it. Natural size.

Fig. 3 *b*. ***The same.*** Portion of a transparent section from the interior of the sponge, showing the disposition of the spicular skeleton. Enlarged thirty-two times. The original silica of the spicules has been entirely replaced by crystalline calcite.

Fig. 4. ***Kalpinella pateræformis,*** Hinde. A vertical median section, showing the disposition of the canals in the sponge-wall. From the Upper Green Sand at Warminster, Wiltshire. Natural size 77

Fig. 5. ***Pholidocladia ramosus,*** Hinde. Showing the empty moulds of the branches of a specimen in a flint from the Upper Chalk. Natural size 81

Fig. 5 *a*. ***The same.*** A fragment of one of the branches from the interior of another flint. Natural size.

Fig. 5 *b*. ***The same.*** Portion of the surface of 5 *a*, enlarged sixty-four times, showing the characters of the spicular skeleton. The small square at the top of the figure indicates its natural size.

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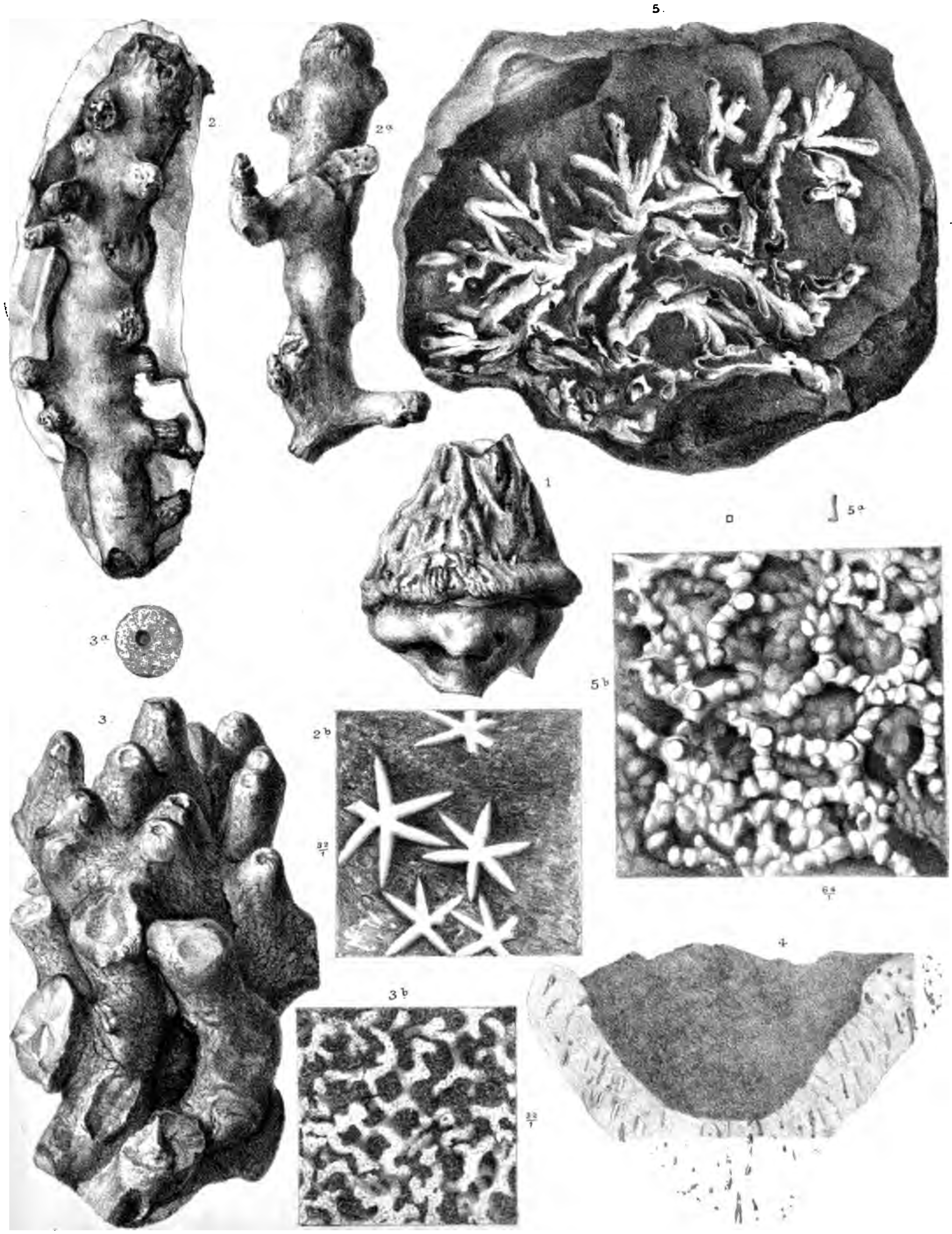

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Fig. 1 *a*. *The same*. Transverse section of the stem, showing the distribution of the canals. Natural size.

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Fig. 4 *a*. *The same*. A small club-shaped specimen, natural size, also from the interior of a flint.

Fig. 4 *b*. *The same*. A portion of the surface of fig. 4, enlarged sixty-four times, showing the spicular skeleton immediately beneath the dermal layer.

Fig. 4 *c*. *The same*. Portion of the surface of fig. 4 where the dermal layer has been preserved, showing the complete head of one spicule and fragments of others. Enlarged thirty-two times.

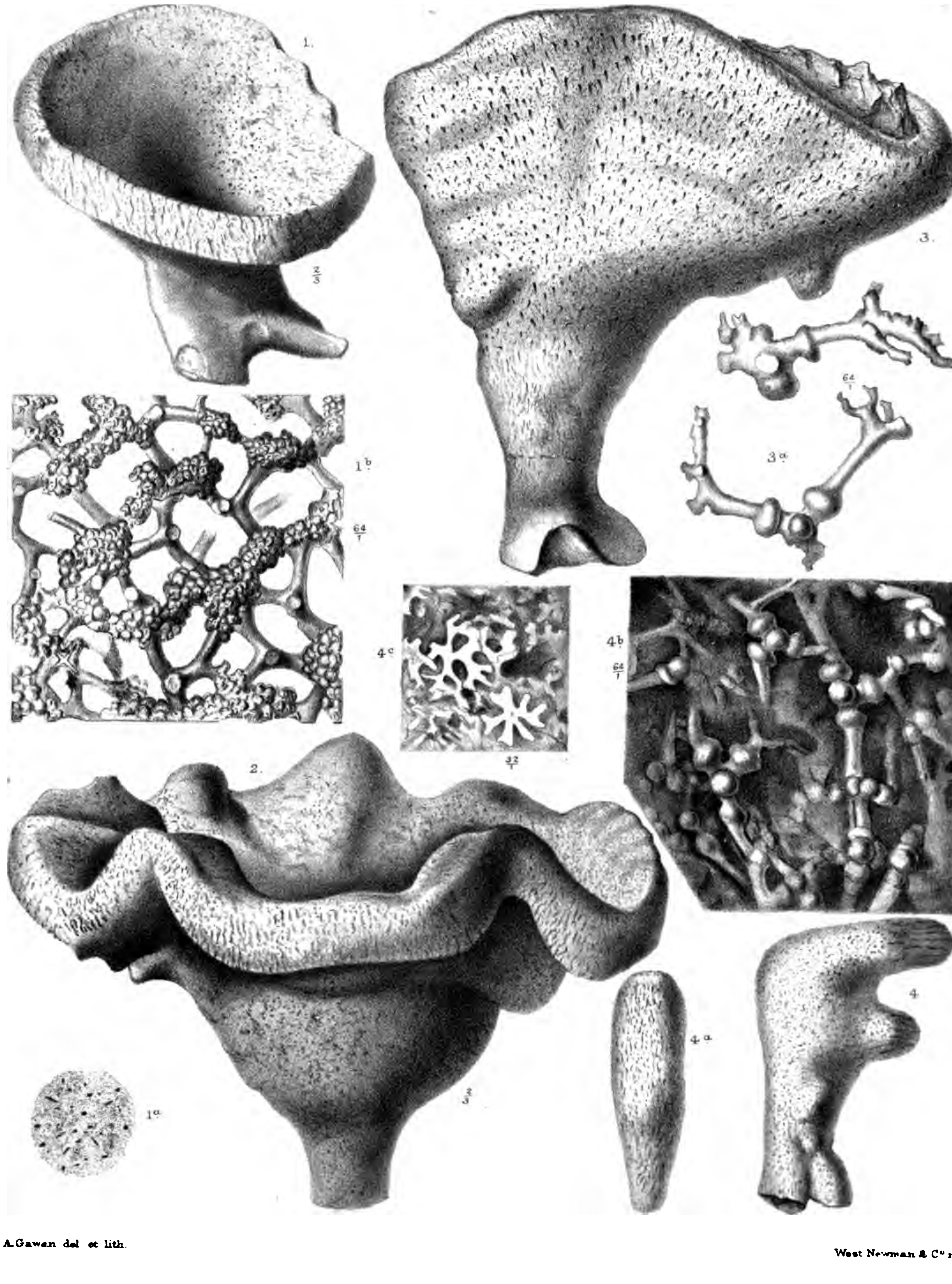

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Fig. 1. *Ragadinia sulcata,* Hinde. An imperfect specimen inclosed in a flint from the Upper Chalk at Beckhampton, Wiltshire. Natural size 83

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Fig. 2. *Plinthosella squamosa,* Zitt. Natural size. From the interior of a flint. The spicular structure has been completely dissolved, and only the empty vermiculate moulds of the spicules remain. Presented to the Museum by Mr. H. J. Carter, F.R.S. 85

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4a
5

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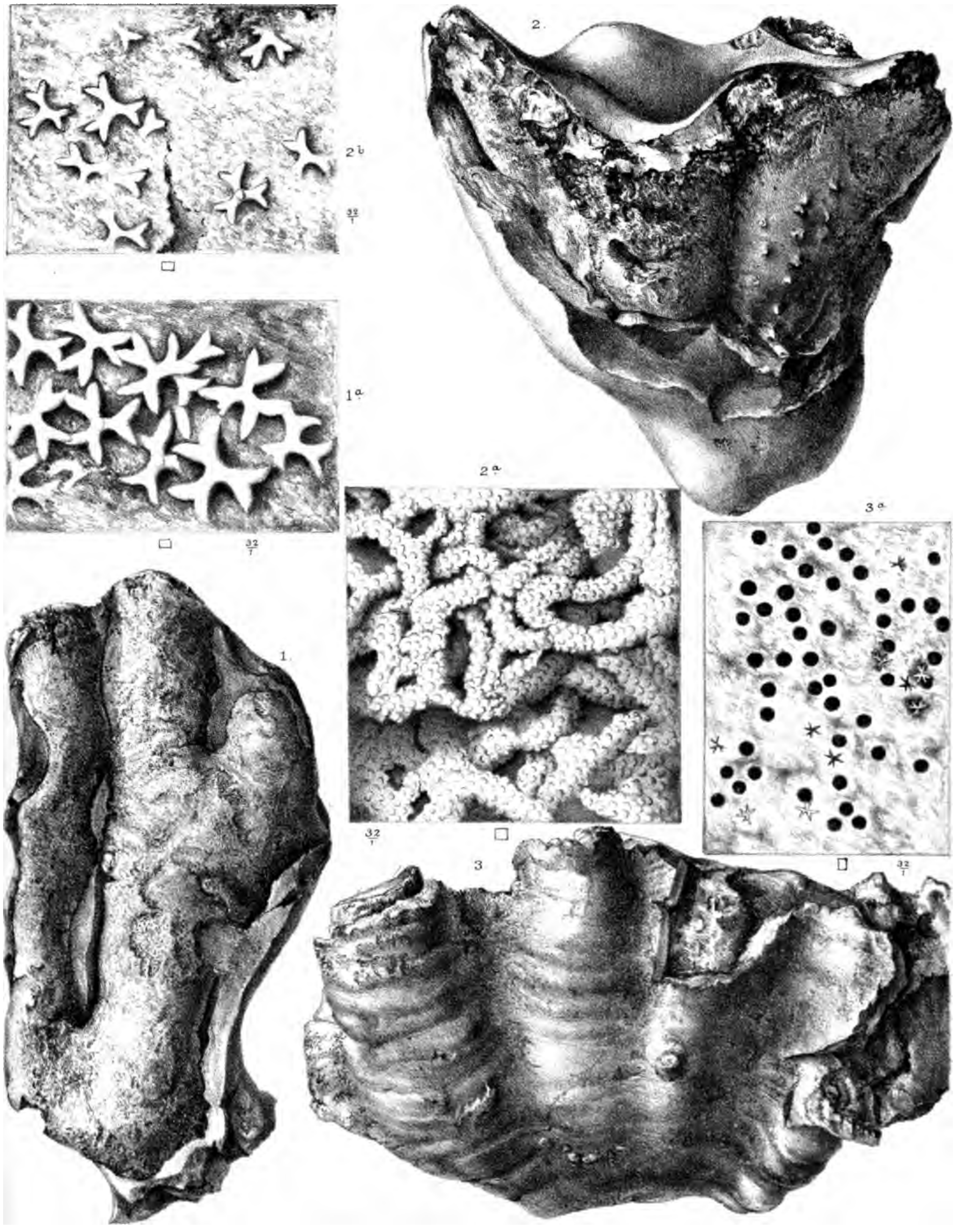
Fig. 3 *a*. ***The same.*** **Portion of the outer surface of fig. 3, enlarged thirty-two times, showing some of the minute spicular heads and the pores of the dermal layer.**



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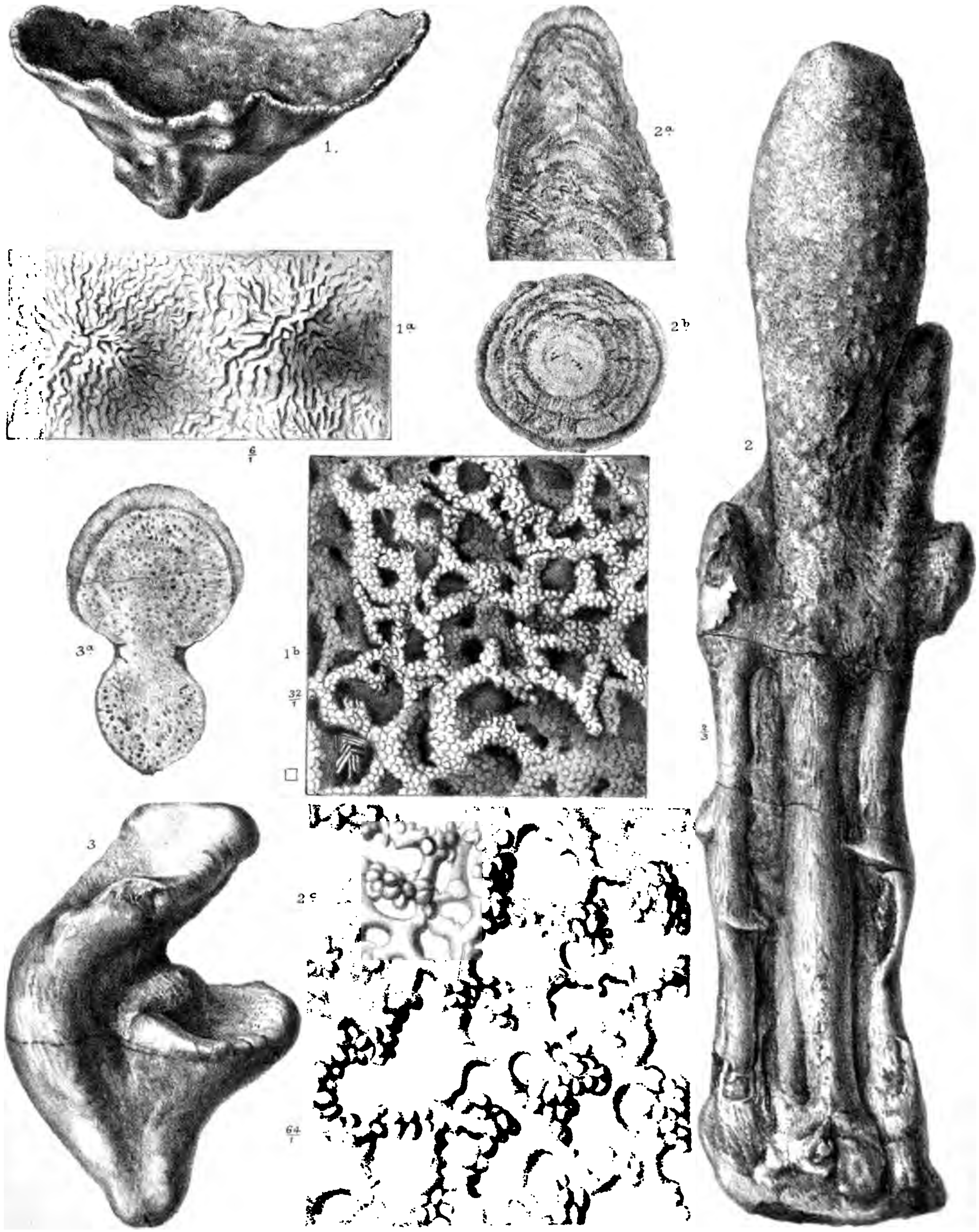

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Fig. 3 *b*. ***The same.*** **Portion of fig. 3 *a*, enlarged sixty-four times, showing the spicular structure of the wall. The spicules have been entirely replaced by calcite of a tint slightly darker than the chalky matrix.**

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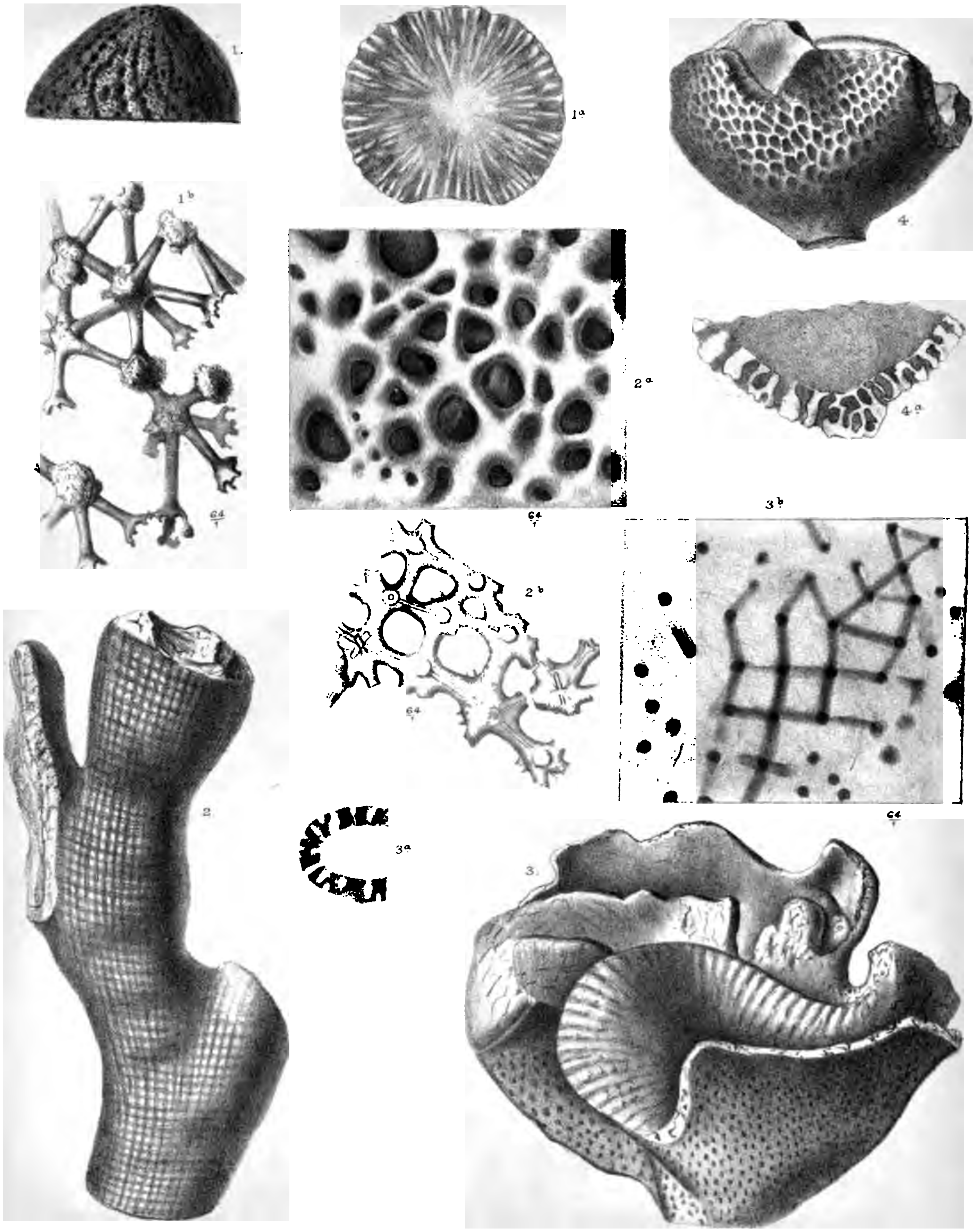

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Fig. 1. ***Stauronema Carteri*, Sollas.** The lower portion of an imperfect specimen from the Upper Green Sand at Cap la Hève, near Havre, showing the inner concave surface. Natural size 99

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Fig. 3 *b*. *The same.* Portion of the spicular mesh of the interior of the wall. Enlarged thirty-two times. Drawn from a fractured surface of one of the projecting tubes.

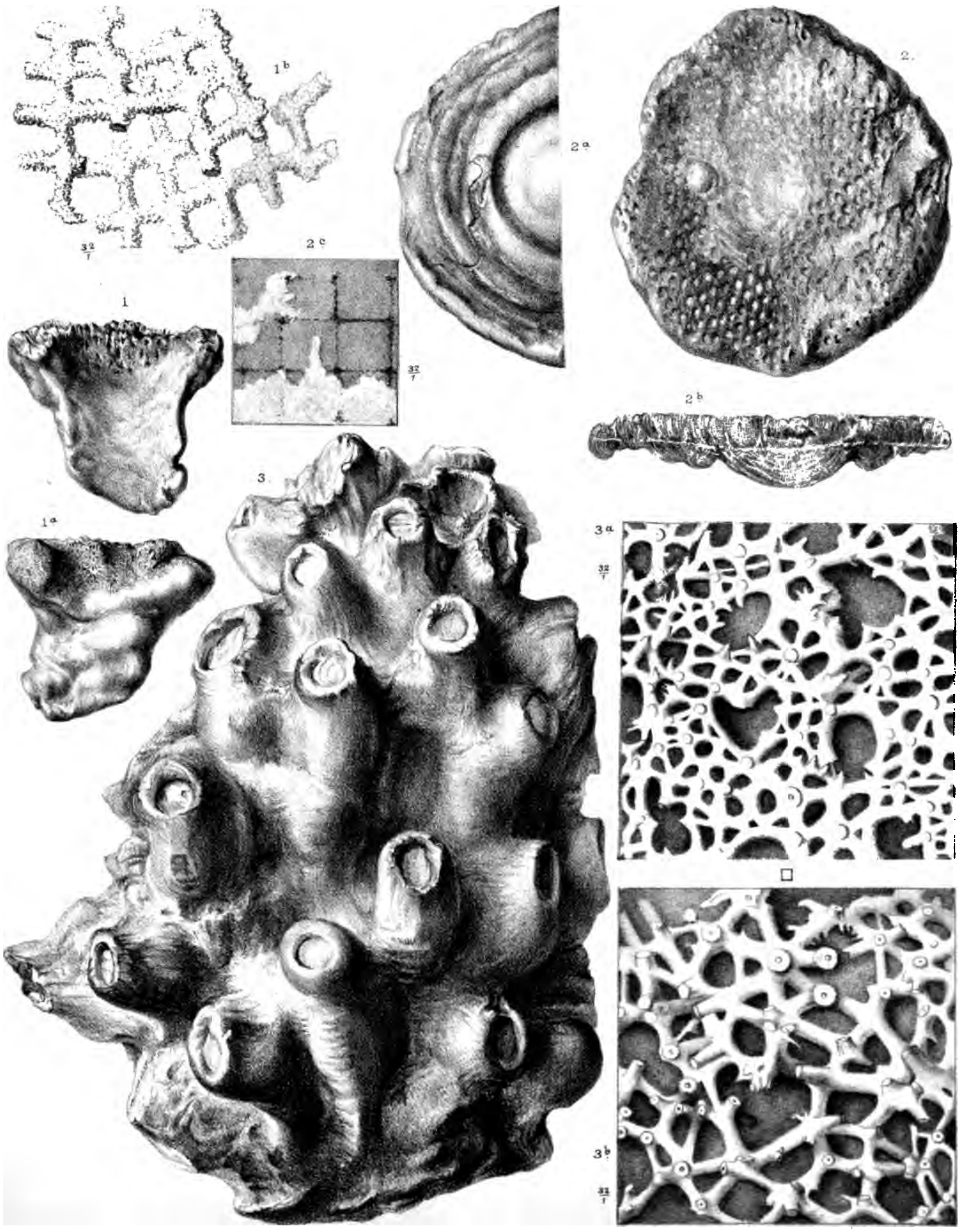

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Fig. 1 *c*. *The same*. Portion of the dermal layer of the outer surface. Enlarged fifteen times.

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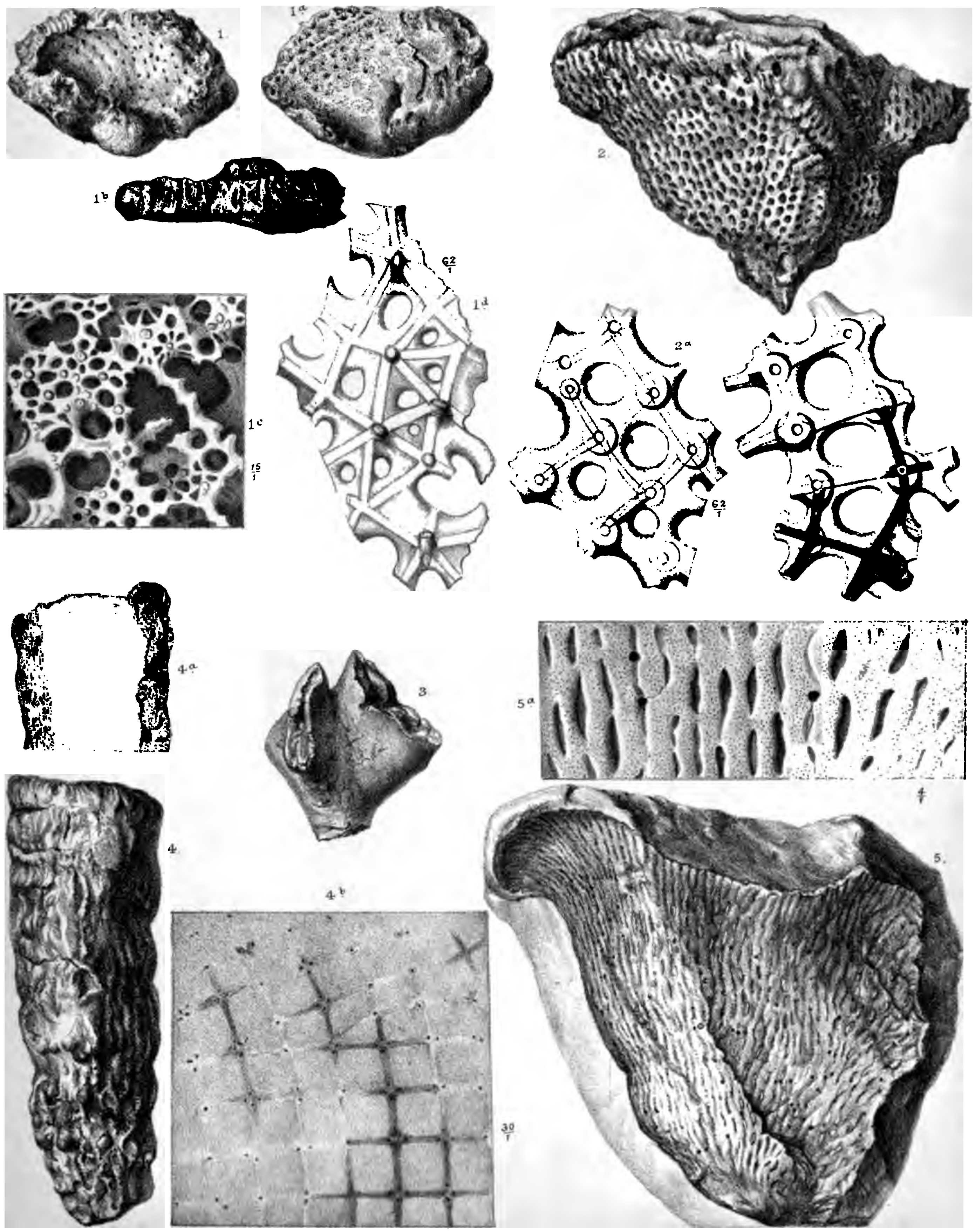
Fig. 4 *b*. *The same*. Portion of the polished surface of 4 *a*, enlarged thirty times, showing the spicular mesh and the octahedral character of the nodes. The spicules have been replaced by calcite, and are consequently indistinct.

Fig. 5. *Ventriculites convolutus*, Hinde. An imperfect specimen, preserved in chalk, showing both the outer and inner surfaces of the wall. Natural size. From the Upper Chalk at Broadstairs, Kent 110

Fig. 5 *a*. *The same*. Portion of the outer surface of fig. 5, enlarged four times, showing the flattened ridges of the wall and the narrow interspaces.



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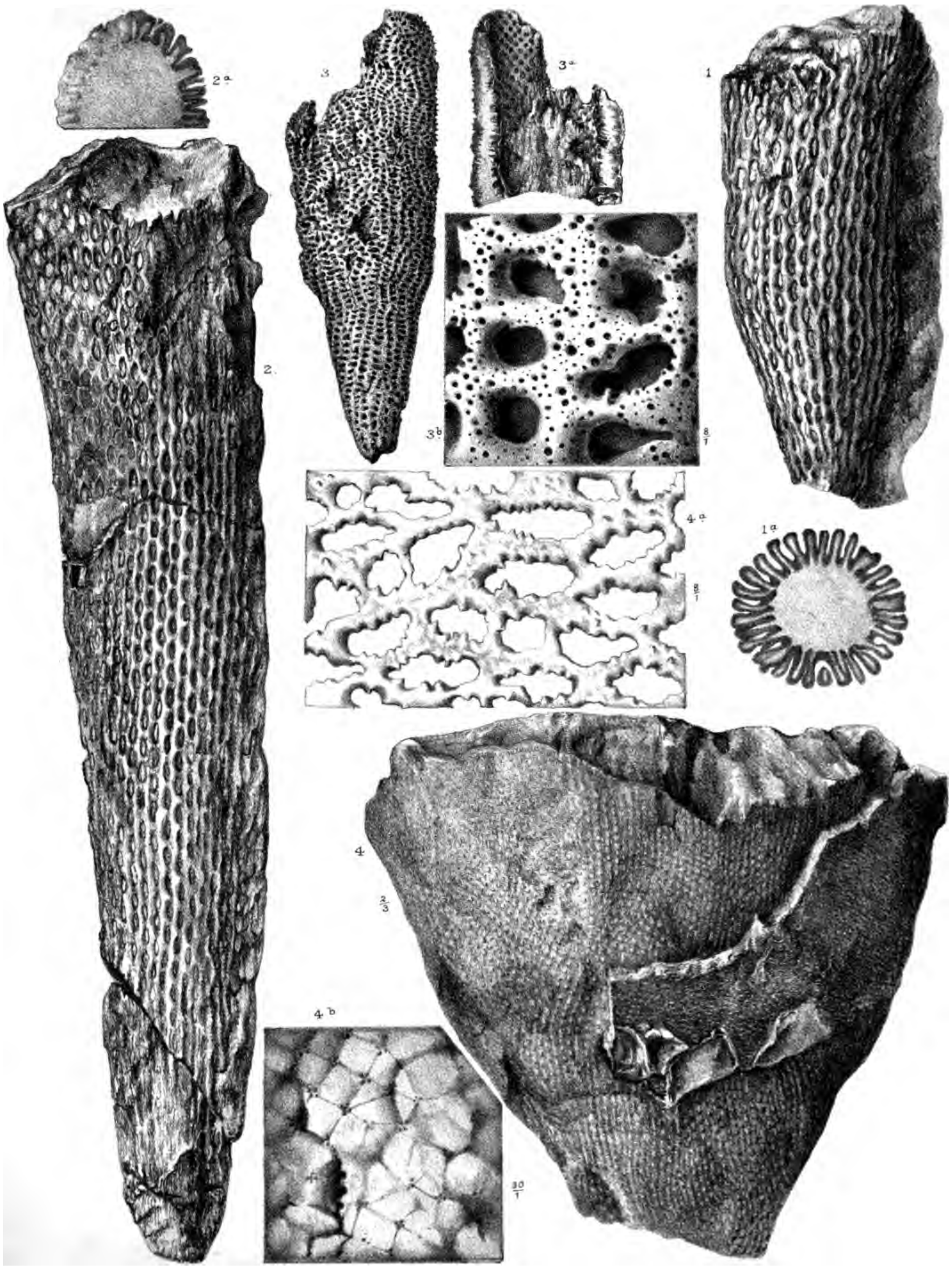

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Fig. 1 *a*. *The same*. A transverse section of one of the branches, showing the thickness of the walls. Natural size.

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Fig. 4 *c*. *The same*. Portion of the spicular mesh of the interior wall-plaits, enlarged thirty times. Only the empty moulds of the spicules are preserved. Drawn from a fractured surface.

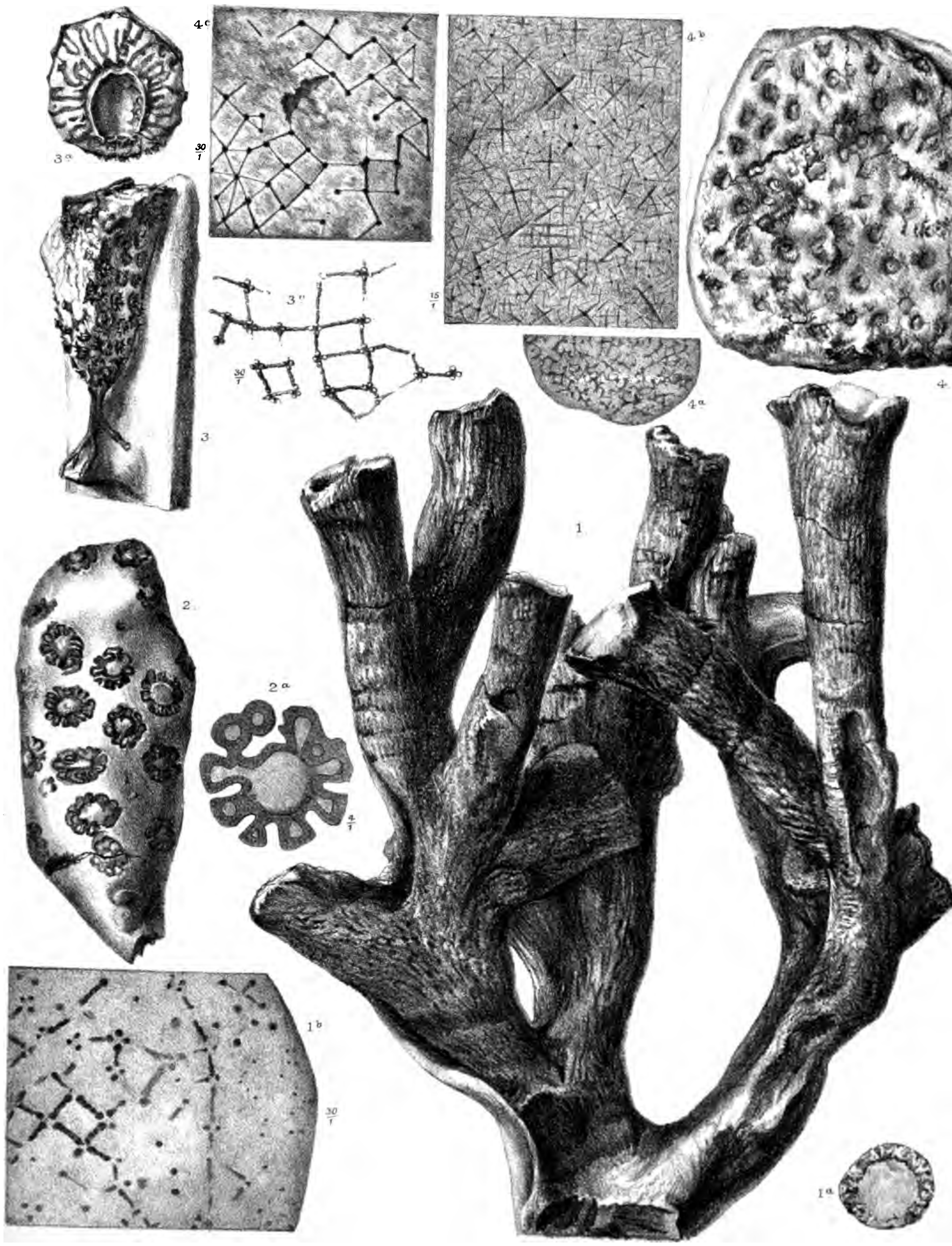

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Fig. 1. *Cincliderma quadratum*, Hinde. The upper portion of a funnel-shaped specimen, from the Upper Chalk of the South of England, showing the dermal layer. Natural size 128

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Fig. 1 *d*. *The same*. Portion of the dermal layer of 1 *a*, enlarged fifteen times. The spicules are only indicated by hollow moulds in the chalky matrix. The minute spicules forming the layer between the framework of larger spicules are too small and too thickly intermingled together to be clearly delineated.

Fig. 2. *Protospongia fenestrata*, Salter. A fragment of a specimen preserved in indurated black shale. Enlarged five times. From Menevian strata at St. David's, South Wales. The spicular framework is now composed of iron pyrites; it has evidently been distorted by pressure from its original rectangular form. The figure is drawn from Salter's type specimen 129

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Fig. 4 *b*. *The same*. A fragment of the spicular mesh of the interior of the wall-plaits, enlarged thirty times.

Fig. 4 *c*. *The same*. A portion of the dermal layer of the wall, enlarged thirty times.

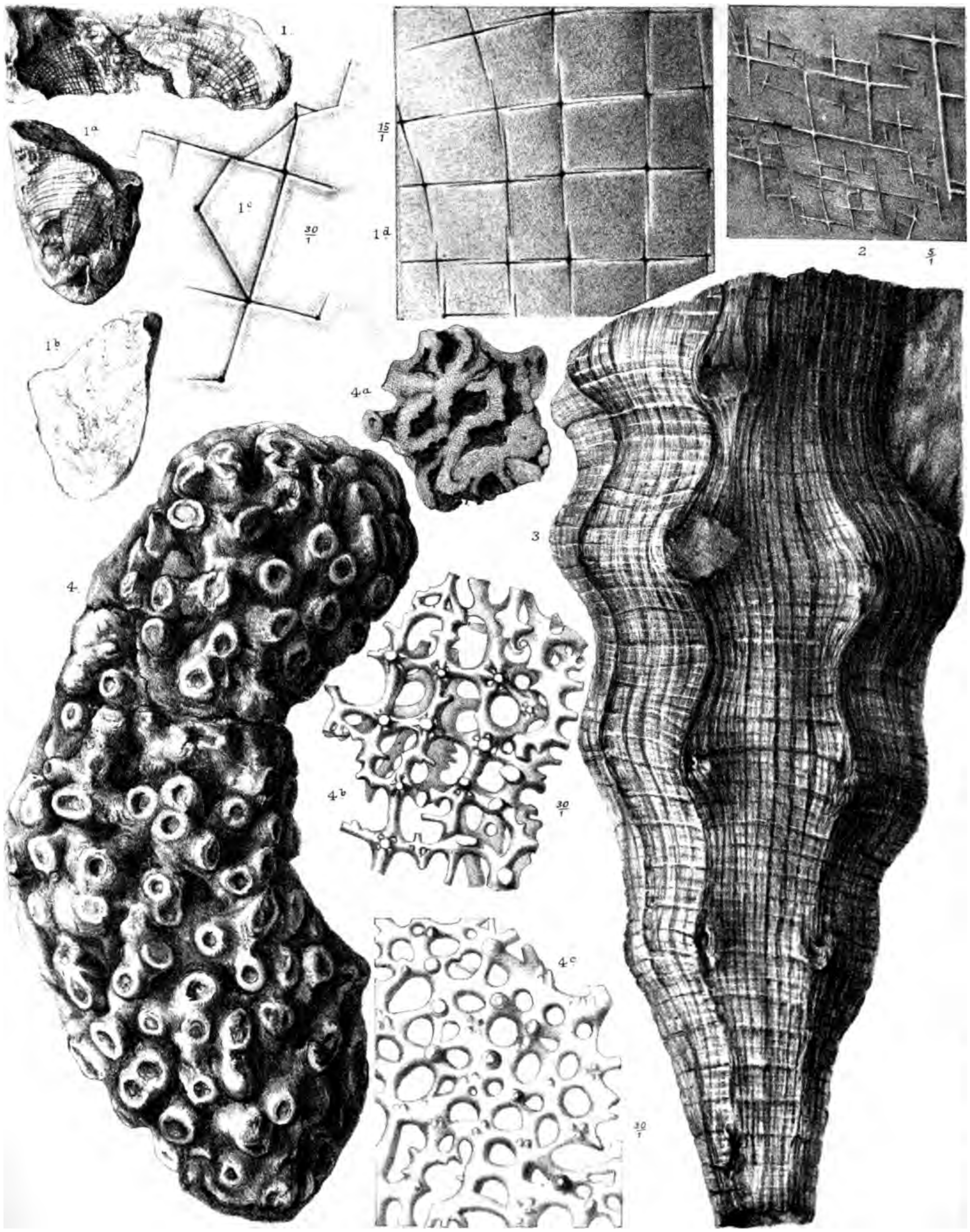

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Fig. 1. *Cœloscyphia sulcata*, Tate. Natural size. From the Spongarian zone of the Chloritic Chalk (*Tate*) (=Upper Chalk), Whitehead, near Belfast. The specimen belongs to the Jermyn-Street Museum 118

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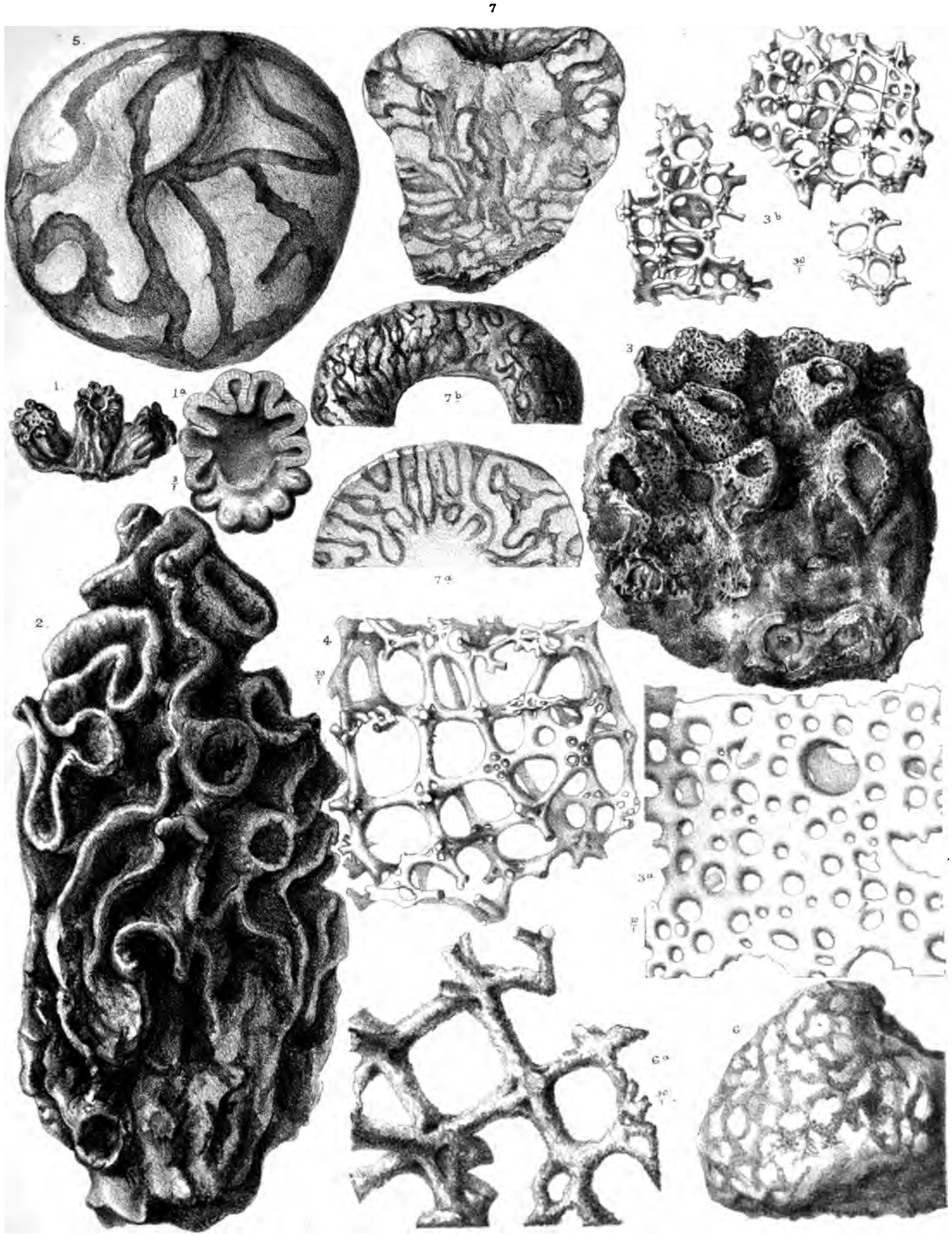

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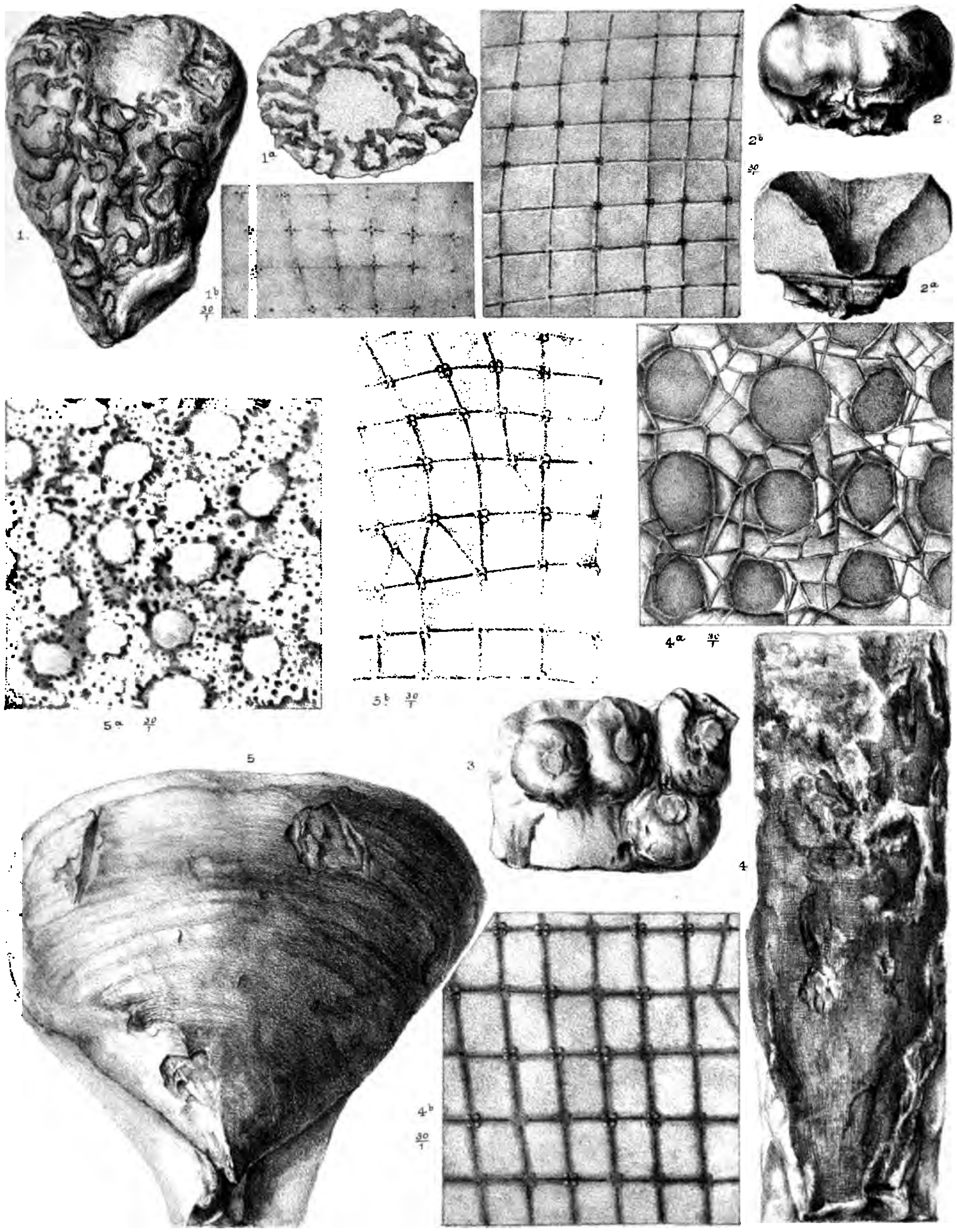

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Fig. 1. *Plectoderma scitulum,* Hinde. A fragmentary specimen, natural size, from Silurian strata of Upper Ludlow age, in the Pentland Hills, near Edinburgh. For the most part only empty moulds of the spicules are preserved, but here and there fragments of siliceous spicules yet remain. The specimen figured belongs to the collection of the Geological Survey of Scotland. It was discovered by Mr. James Bennie 132

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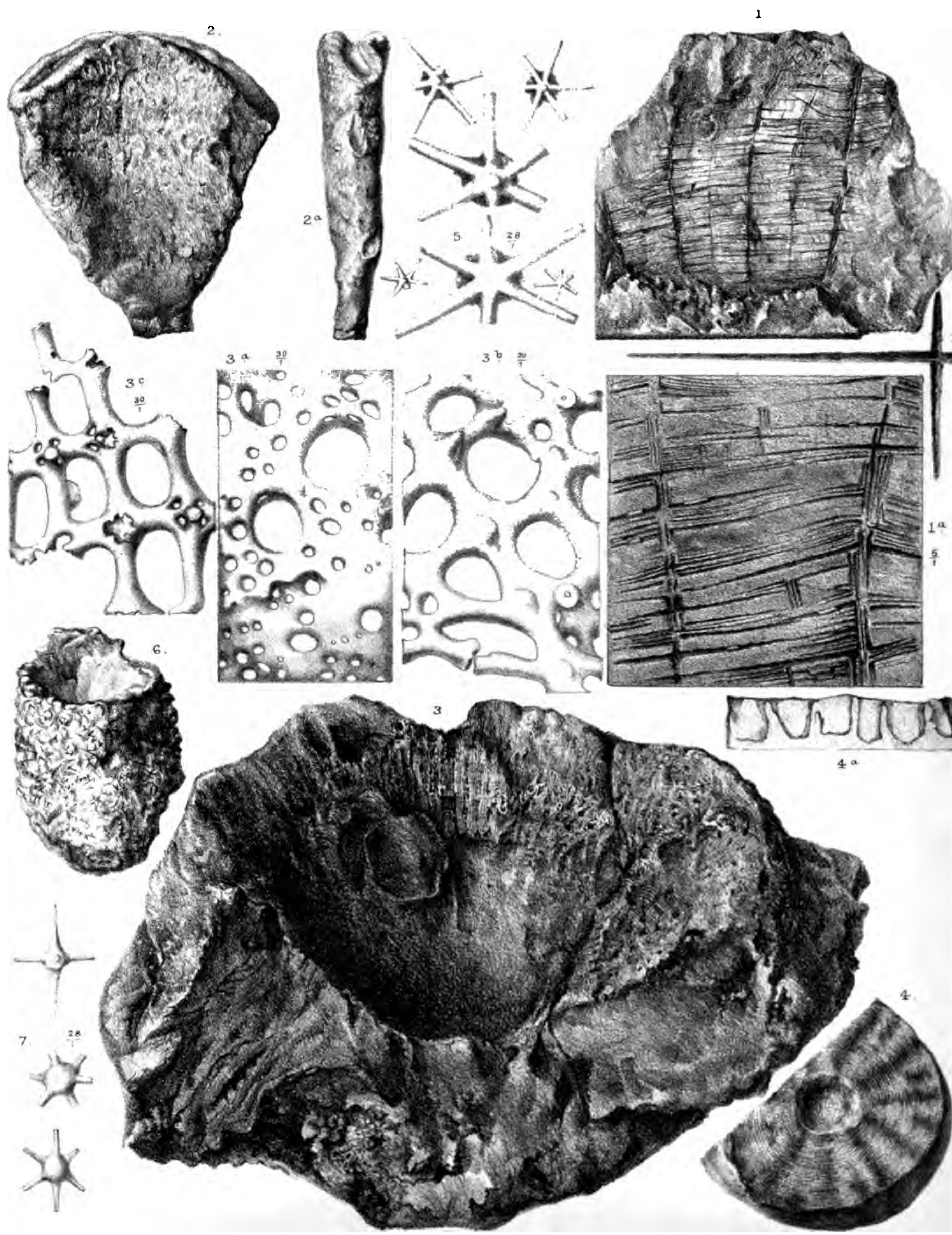

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Figs. 1–1 *g*. ***Hyalostelia Smithii***, Young and Young, sp. Detached spicules of this species. Enlarged fourteen times. Figs. 1 to 1 *d* are simple hexactinellid forms; in 1 and 1 *c* one of the spicular rays is reduced to a rounded knob; figs. 1 *e*, 1 *f*, and 1 *g* are terminal portions of the spicular rods with four recurved rays. From Lower Carboniferous Limestone at Cunningham Baidland, near Dalry, Ayrshire 150

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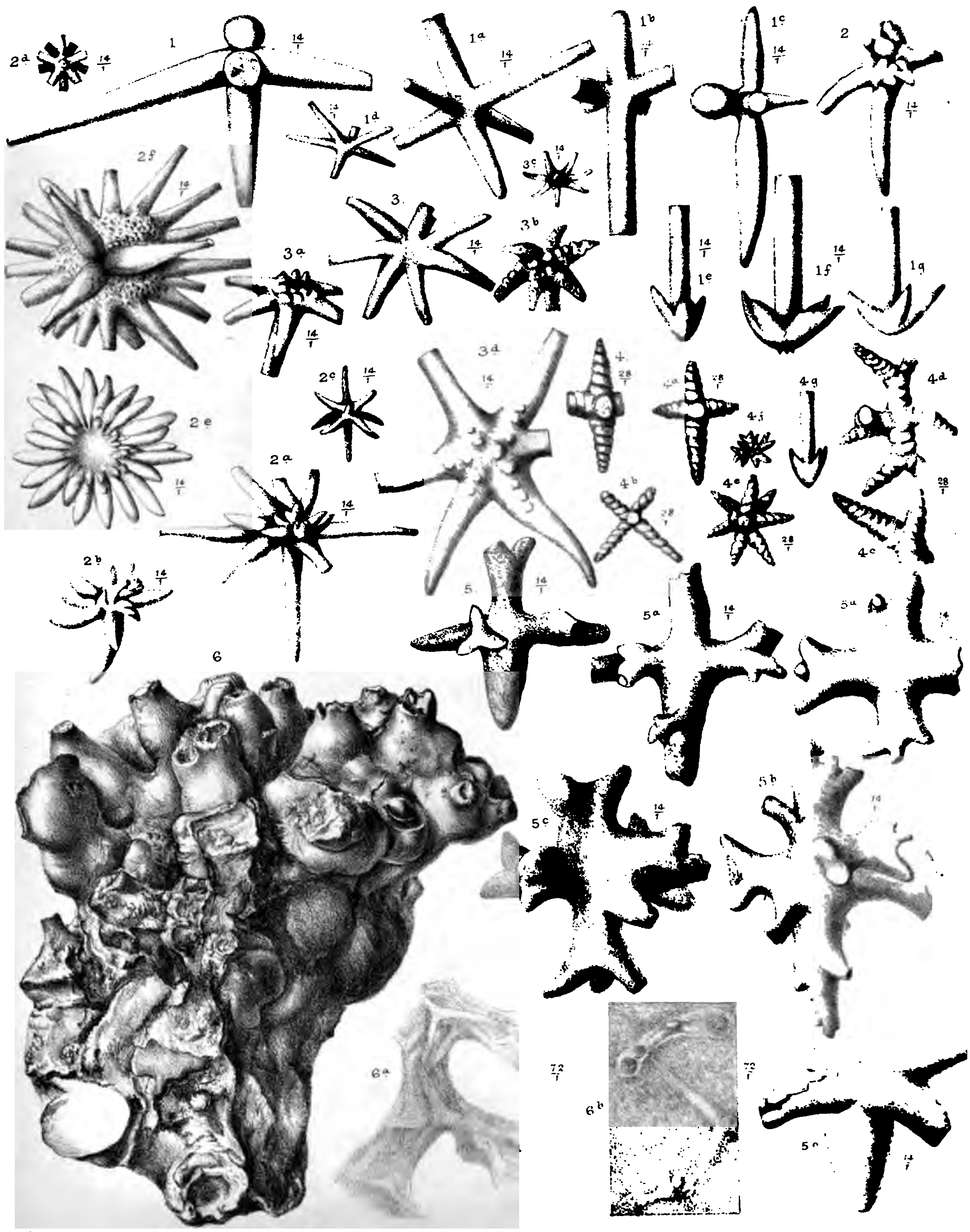

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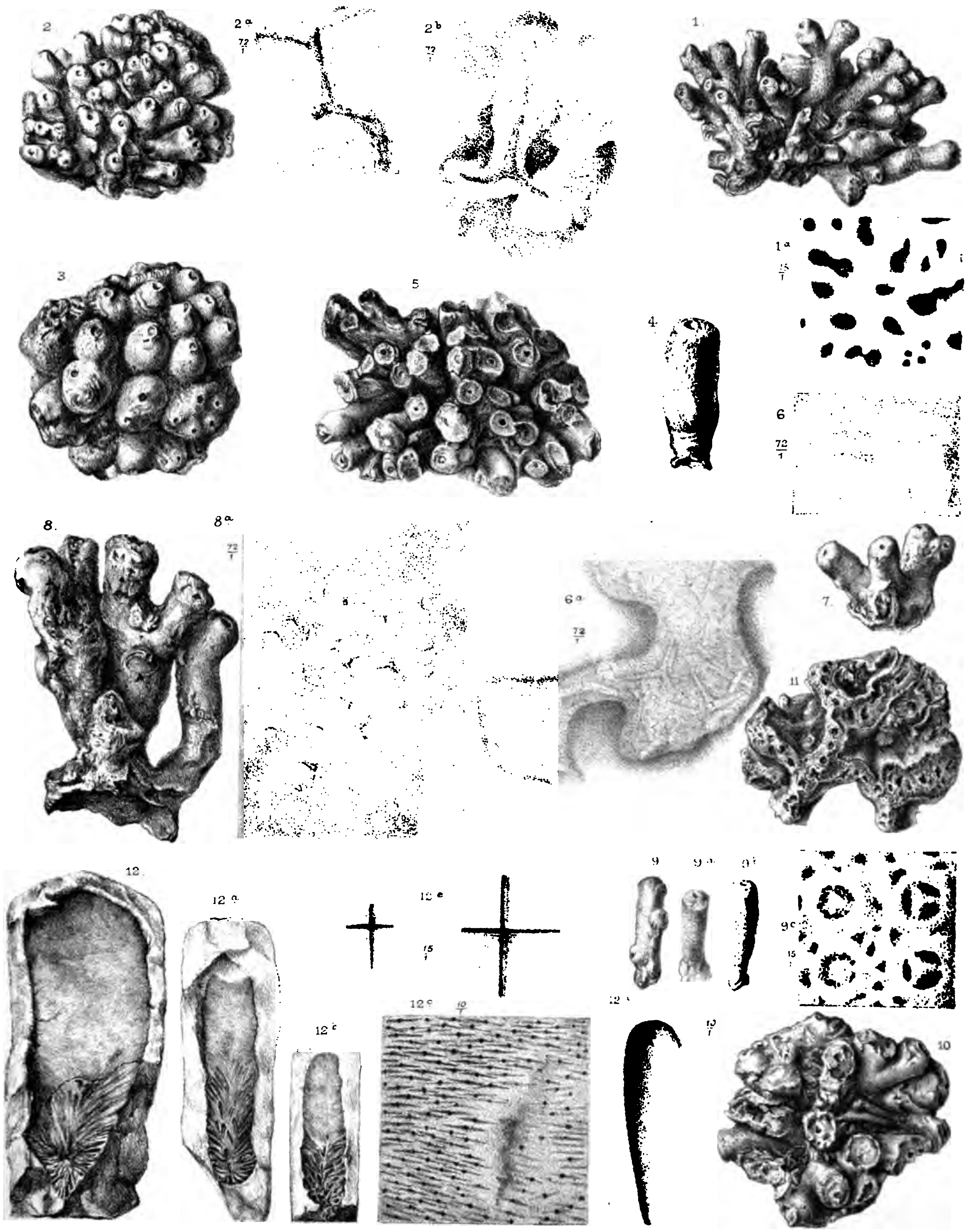

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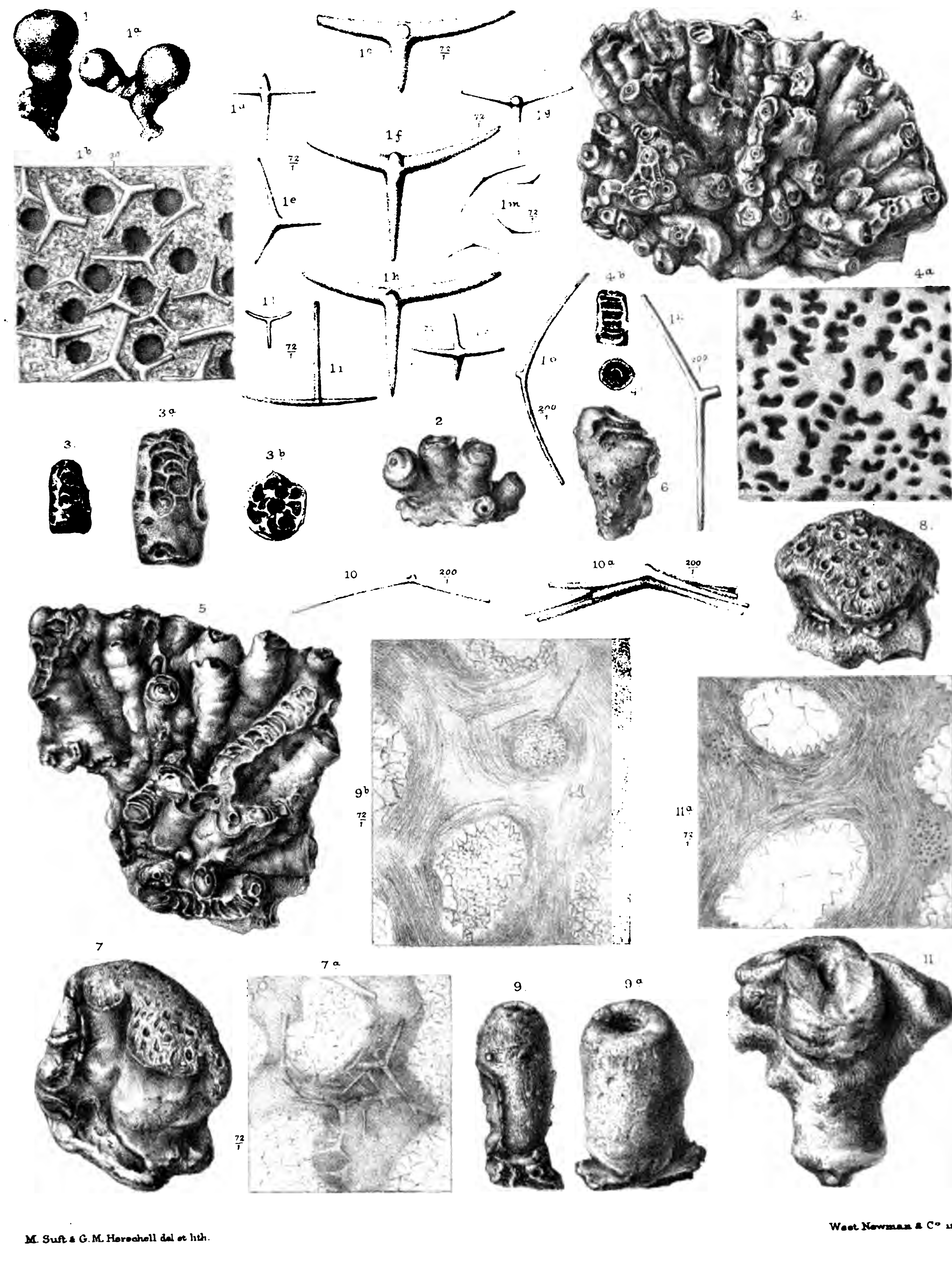

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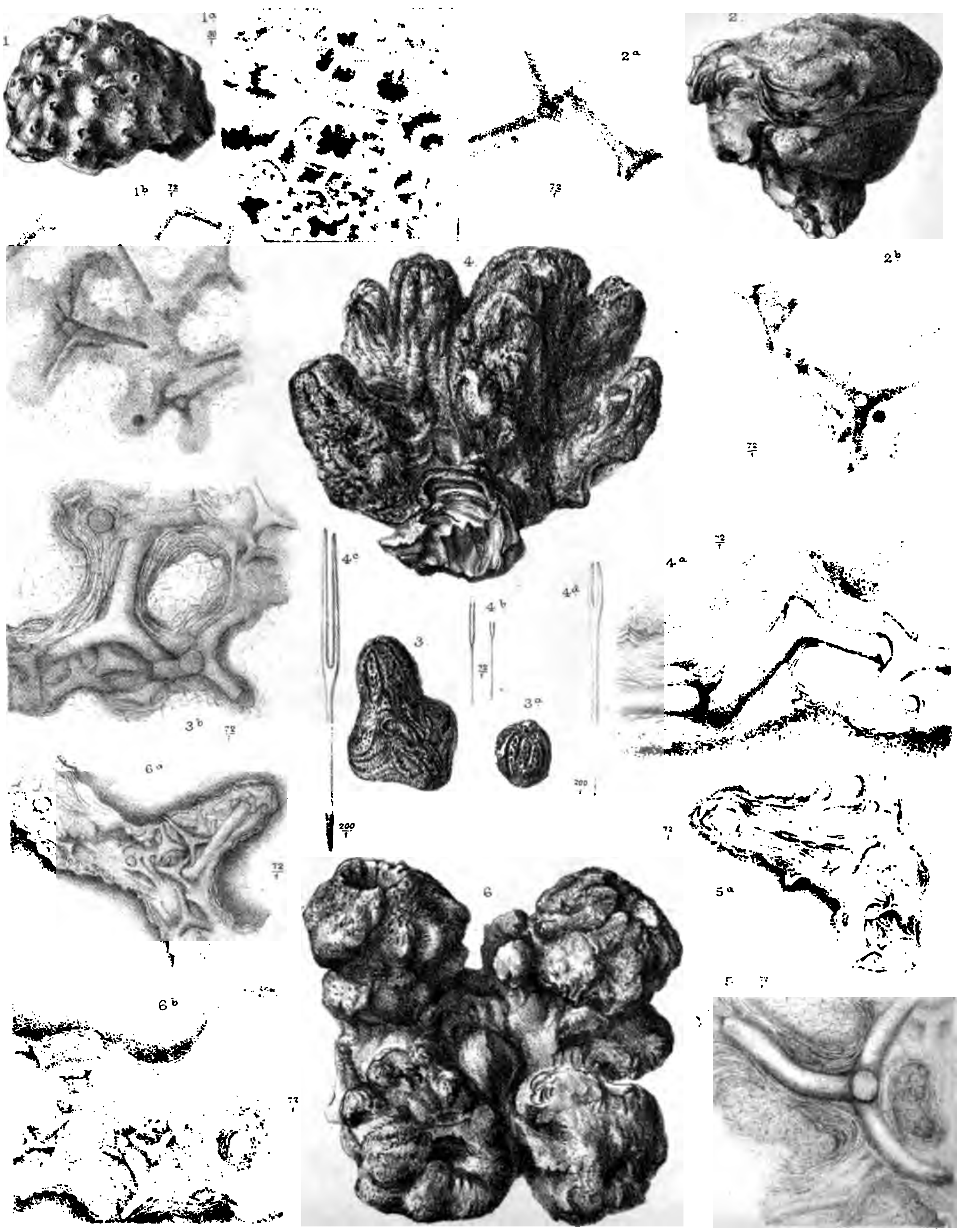

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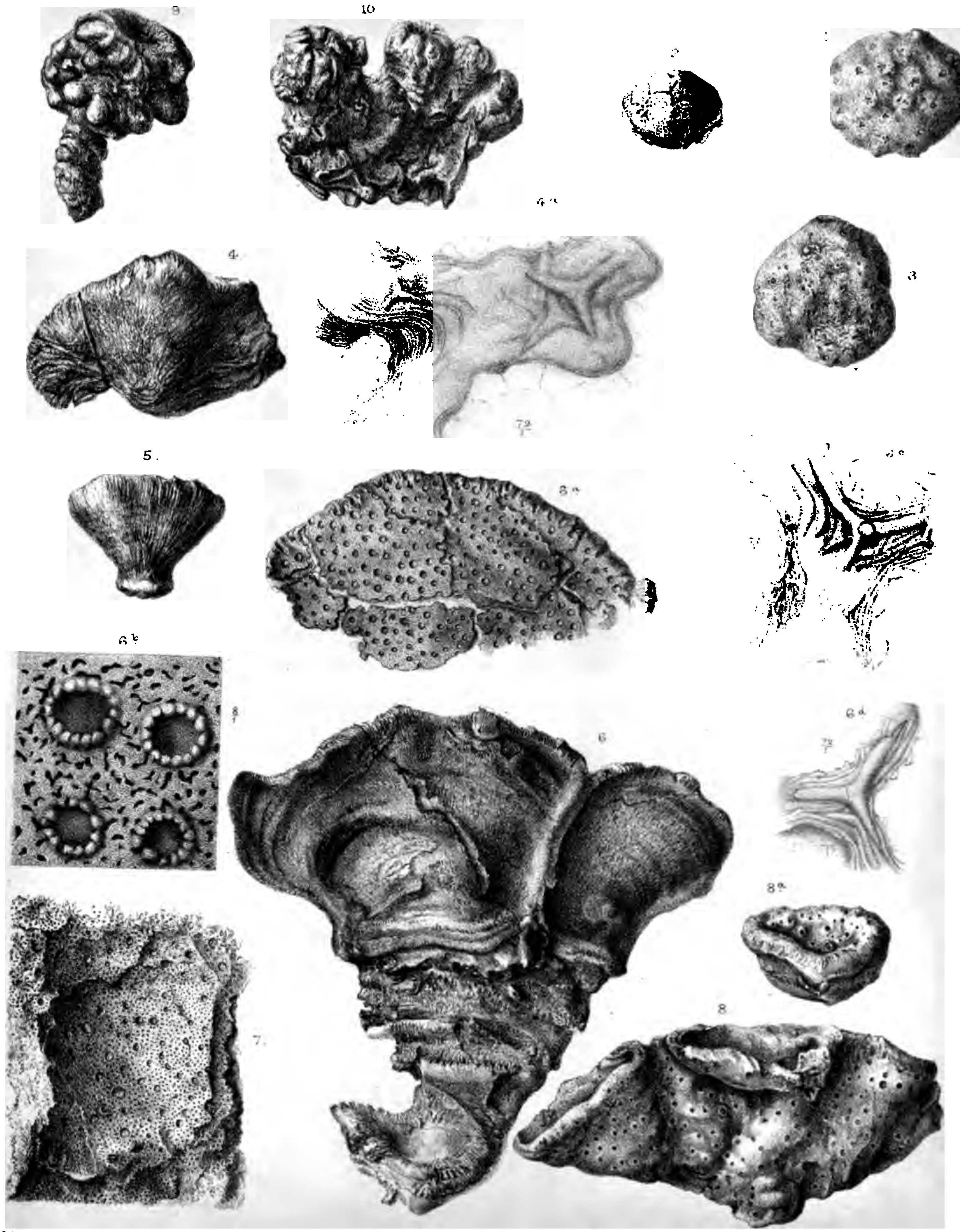

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Fig. 3. ***Raphidonema porcatum,*** Sharpe, sp. Natural size. An irregularly convolute specimen, showing the sinuous anastomosing ridges of the under or outer surface of the wall. From the Lower Green Sand at Farringdon 198

Fig. 4. ***Raphidonema macropora,*** Sharpe, sp. Natural size. A small cup-shaped example, showing the nodose outer surface of the wall and a portion of the interior surface with the horizontally disposed apertures in the dermal layer. From the Lower Green Sand at Farringdon 199

Fig. 5. ***Raphidonema Farringdonense,*** Sharpe, sp. Natural size. An average specimen, showing the nodose character of the outer surface of the wall and a portion of the interior, with the irregularly disposed canal-apertures. The smooth dermal layer of the interior is limited in this specimen to the lower portion of the surface of the cup. The smooth surface which conceals the canals near the upper margin to the right is produced by an adnate polyzoon. From the Lower Green Sand at Farringdon 200

Figs. 5 *a*, *b*. ***The same.*** Fragments of the fibres of the interior, enlarged seventy-two times, showing the closely arranged filiform three-rayed spicules. The fibres are surrounded by a layer of crystalline calcite. Drawn from a transparent microscopic section.

Fig. 6. ***Pharetrospongia Strahani,*** Sollas. Natural size. A cup-shaped example, showing the thickness of the wall and the smooth reticulate character of its inner surface. From the Upper Chalk of Kent 201

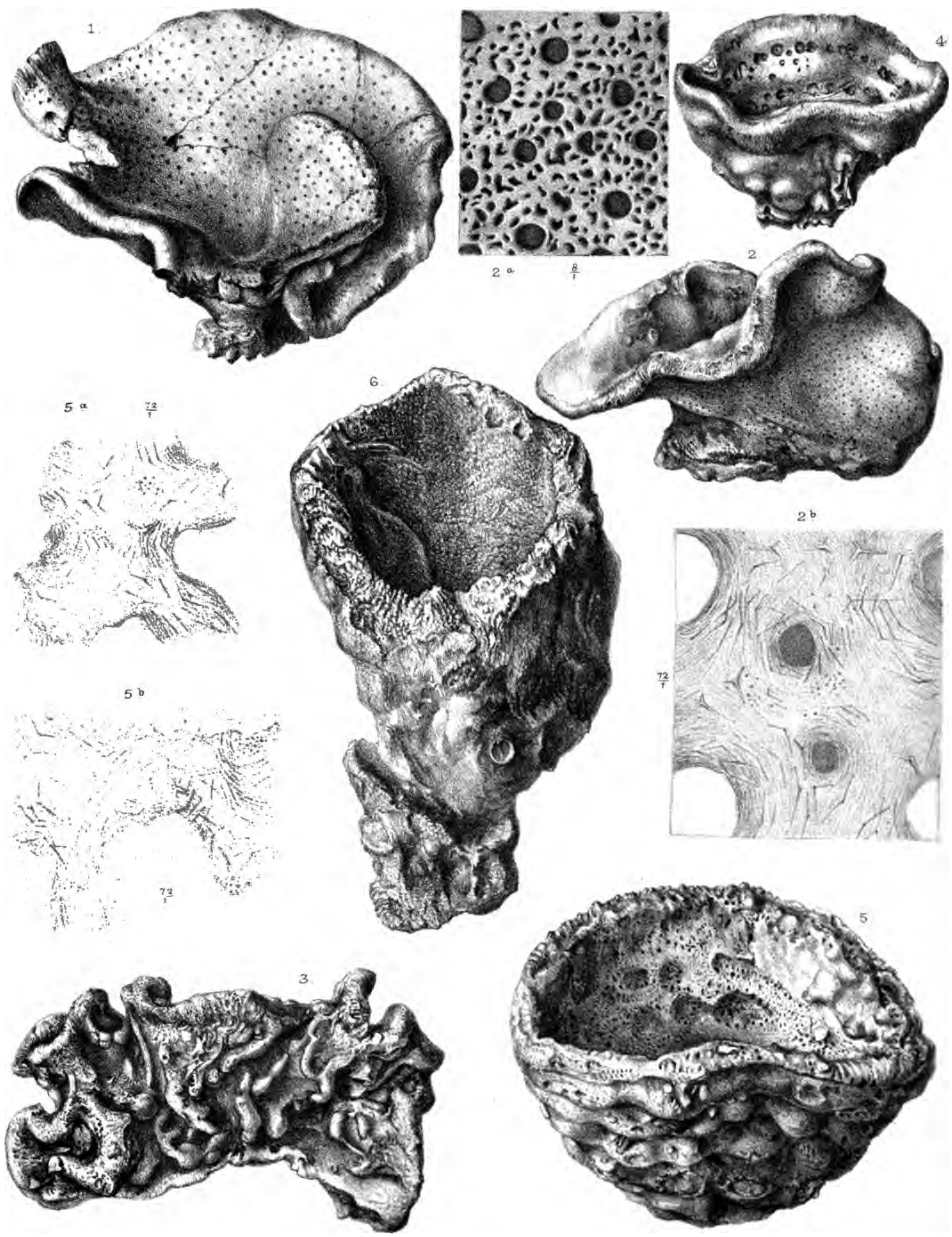

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PLATE XXXVIII.

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Fig. 1. *Pharetrospongia Strahani,* Sollas. A fragment of the interior fibre, enlarged seventy-two times, showing traces of the spicular structure. Drawn from a transparent microscopic section of an entirely calcareous specimen. From the Cambridge Green Sand 201

Figs. 2, 2 *a*, 2 *b*. *Protosycon punctatum,* Goldf. sp. Two specimens of average dimensions—fig. 2 *a* is enlarged twice; 2 *b* shows the cloacal aperture at the summit. From the Upper Jura at Streitberg 204

Fig. 2 *c*. *The same.* A vertical median section of a specimen, natural size, showing the thickness of the wall, and the cloacal tube filled with the matrix.

Fig. 2 *d*. *The same.* A portion of the wall of 2 *c*, enlarged twenty-eight times, showing sections of the spicules bounding the horizontal canals. Drawn from a transparent microscopic section.

Fig. 2 *e*. *The same.* A portion of 2 *d*, enlarged seventy-two times, showing sections of three-rayed spicules.

Figs. 3, 3 *a*, 3 *b*, 3 *c*. *Bactronella pusillum,* Hinde. Three specimens of average dimensions. Fig. 3 *a* is enlarged twice, the other figures are natural size. From the Upper Jura, probably from Thurnau, Bavaria 205

Fig. 3 *d*. *The same.* A segment of a transverse section, enlarged twenty-eight times, showing traces of the canals in the marginal portion, and the general appearance of the central part of the sponge. Drawn from a transparent microscopic section.

Fig. 3 *e*. *The same.* A part of the margin of 3 *d*. Enlarged seventy-two times. The dark portions indicate the canals filled by the dark matrix, whilst the lighter parts are sections of spicules.

Fig. 3 *f*. *The same.* A part of the dark central portion of the sponge, enlarged seventy-two times, showing fragments of three-rayed spicules.

Fig. 3 *g*. *The same.* A part of a three-rayed spicule, enlarged two hundred times, showing the spinous character of the rays.

Figs. 4, 4 *a*. *Haplistion fractum,* Hinde. Two detached fragments of the fibres, enlarged fourteen times, showing the weathered-out spicules on the surface. Drawn by reflected light. From the Lower Carboniferous at Law Quarry, Dalry, Ayrshire 207

Figs. 5, 5 *a*, 5 *b*. *Geodia ? antiqua,* Hinde. Three detached trifid spicules, with imperfect shafts. Enlarged fourteen times. From the Lower Carboniferous at Law Quarry, Dalry 208

Fig. 5 *c*. *The same.* A portion of a curved acerate spicule. Enlarged fourteen times. From Dalry.

Figs. 5 *d, e*. *The same.* Two bifid spicules with imperfect shafts. Enlarged fourteen times. The surface of 5 *e* shows in places small rhombohedral excavations. From Dalry.

Figs. 6, 6 *a*–6 *f*. *Pachastrella vetusta,* Hinde. Detached spicules with four, and in one

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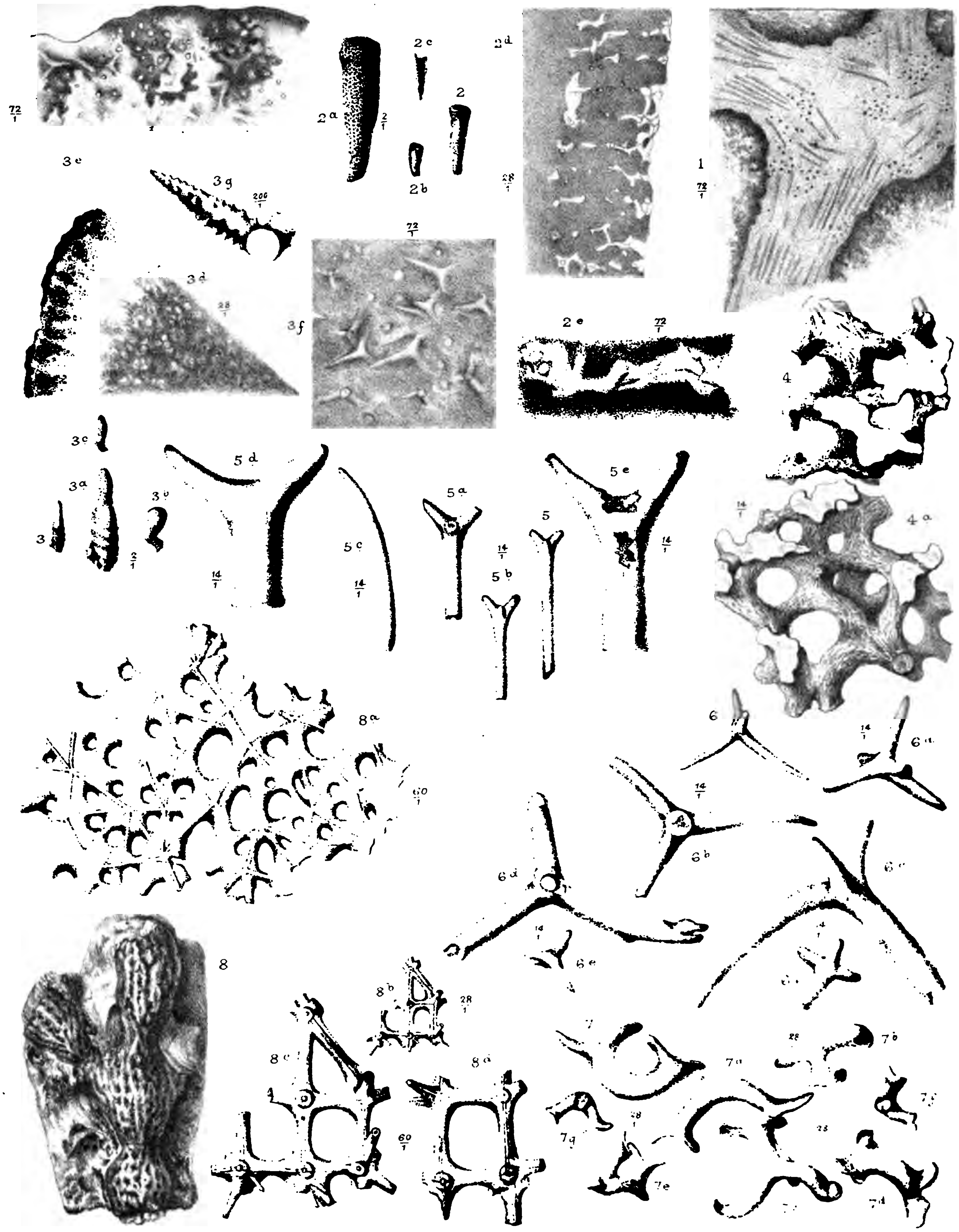
specimen five rays. Enlarged fourteen times. From the Lower Carboniferous at Law Quarry, Dalry, Ayrshire 209

Figs. 7, 7 *a*–7 *g*. *Doryderma Dalryense*, Hinde. Detached spicules of various forms. Enlarged twenty-eight times. Figs. *f* and *g* are from the Carboniferous at Ben Bulbul, near Sligo; the others are from the Law Quarry, Dalry 210

Fig. 8. *Sporadopyle Santanderi*, Hinde. Natural size. From the Neocomian at Santander, Spain 210

Fig. 8 *a*. *The same*. A fragment of the dermal layer of the same specimen, enlarged sixty times, showing the interior spicular canals. Drawn under the camera lucida.

Figs. 8 *b*, *c*, *d*. *The same*. Fragments of the interior spicular mesh, showing the canals. Fig. 8 *b* is enlarged twenty-eight times, 8 *c* and *d* sixty times.



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